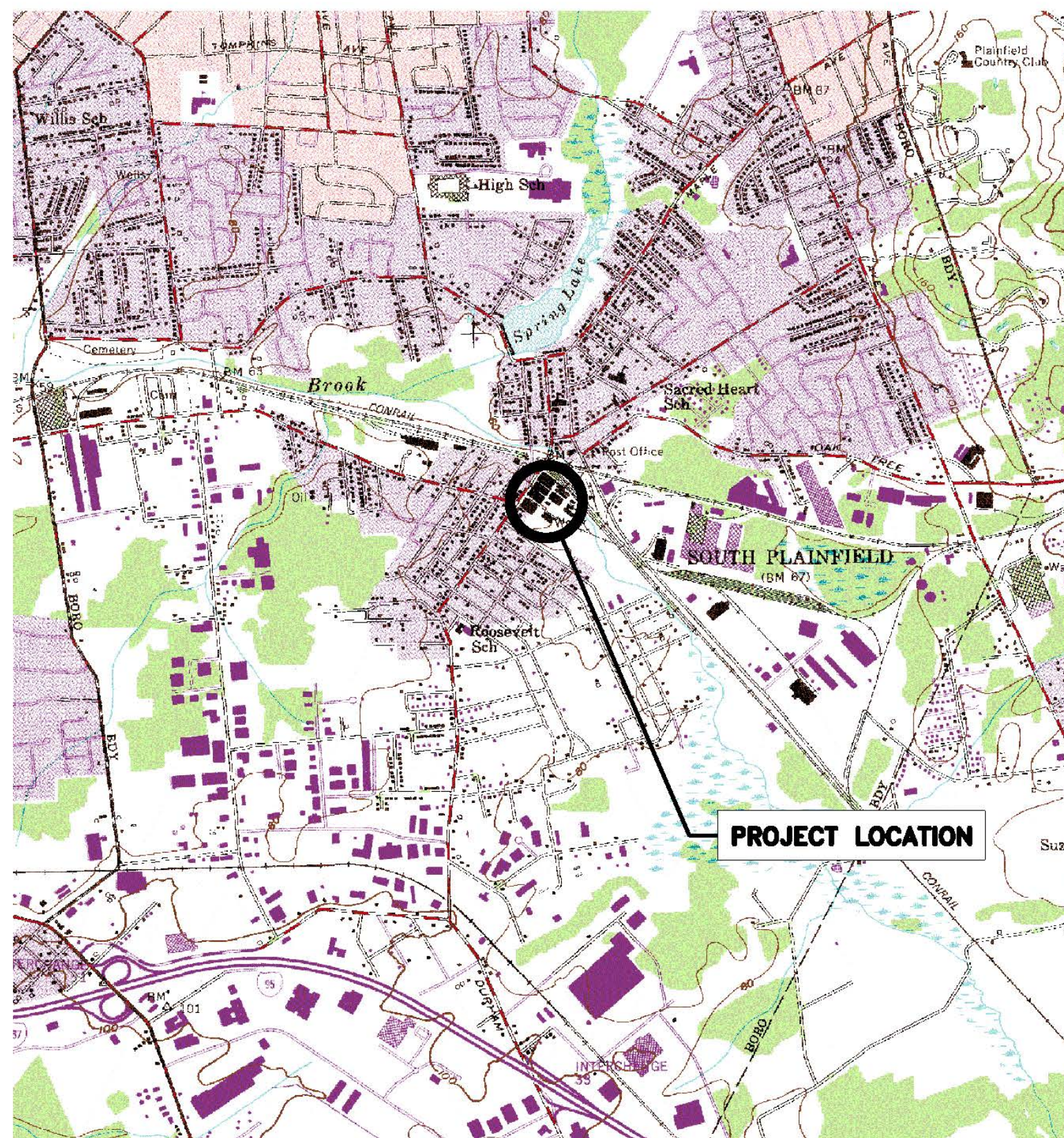


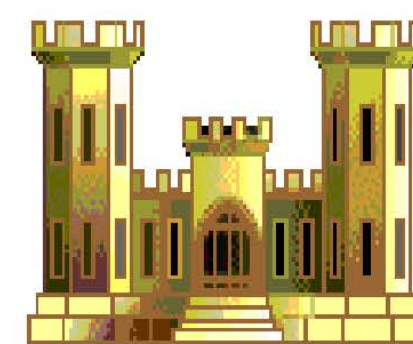
**BOROUGH OF SOUTH PLAINFIELD  
MIDDLESEX COUNTY, NEW JERSEY**



12,000 0 24,000  
SCALE: 1" = 24,000'



600 0 1200  
SCALE: 1" = 1200'



Sevenson  
Environmental  
Services, Inc.



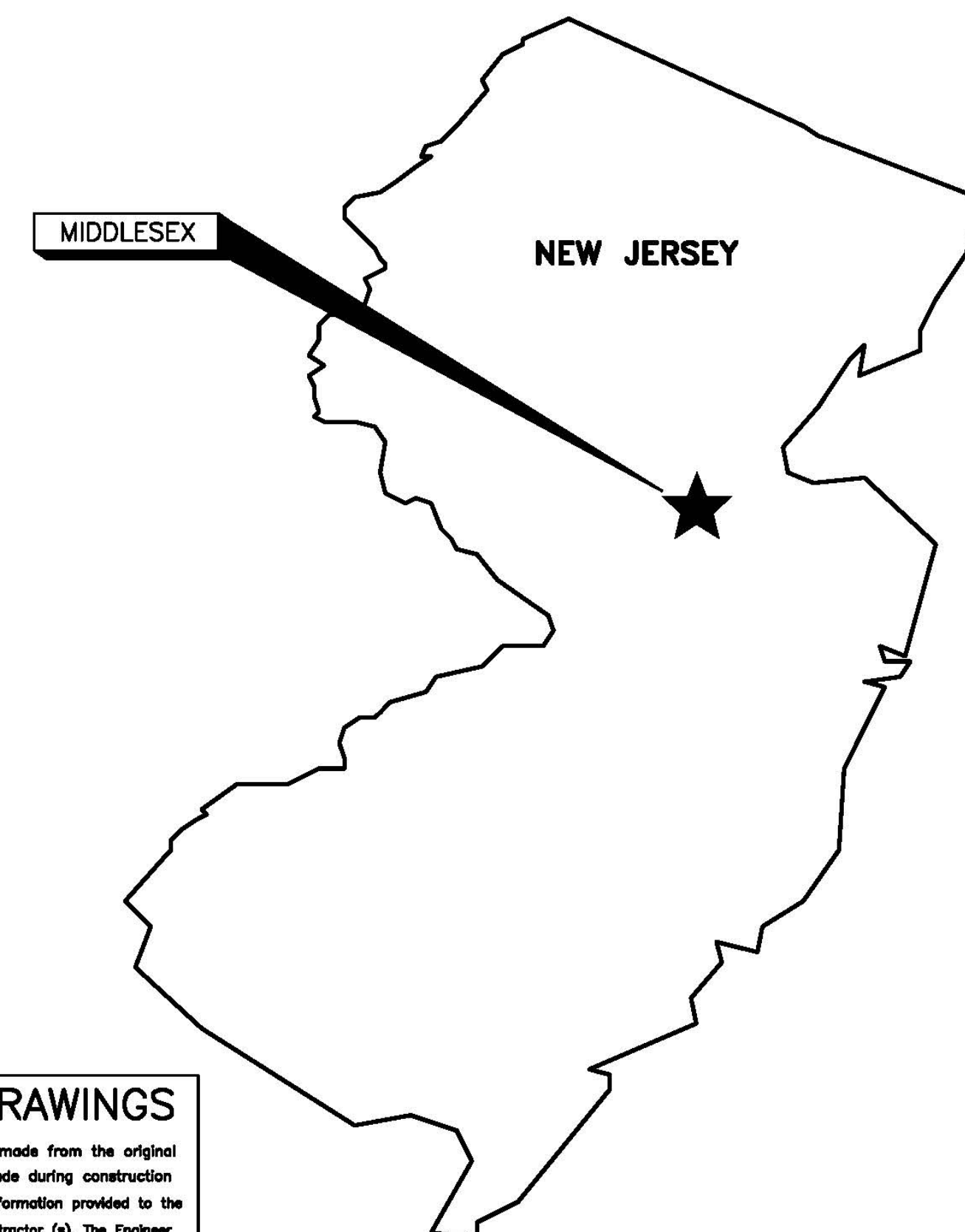
**ARCADIS**



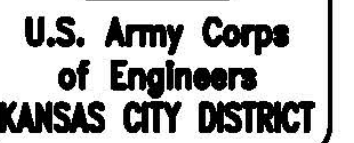
RECORD DRAWINGS

This drawing reflects changes made from the original contract drawing that were made during construction and has been prepared from information provided to the Engineer by the construction contractor (s). The Engineer does not warrant this drawing to be complete and accurate in all respects.

Date 9/13 By LB / ARCADIS



NOT TO SCALE



Revisions			
Symbol	Description	Date	Approved
1	RECORD DRAWINGS	9/13	CUD

Designed by: <b>MMN</b>	Date:	Approved by:  Date:	File Name: <b>G01--4553COV.DWG</b>
	Drawn by:		
CD	Date:	Reviewed by: <b>BG</b>	

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CORPS OF ENGINEERS  
KANSAS CITY DISTRICT  
KANSAS CITY, MISSOURI**

**ARCADIS**  
44 SOUTH BROADWAY, 15th FLOOR  
WHITE PLAINS, NEW YORK 10801

**CORNELL-DUBILIER ELECTRONICS  
SUPERFUND SITE OU2 SOILS REMEDIATION  
SOUTH PLAINFIELD, NEW JERSEY**

COVER SHEET I

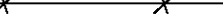


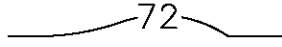

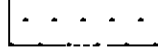












G-01

Sheet 1 of 9

## INDEX OF DRAWINGS

DRAWING NO.	TITLE	NOTES
G-01	COVER SHEET	
G-02	INDEX OF DRAWINGS, LEGEND, ABBREVIATIONS & GENERAL NOTES	
G-03	EXCAVATION PLAN	
G-04	BOTTOM OF EXCAVATION ELEVATIONS	
G-05	PAVING AND DRAINAGE PLAN	
G-06	MISCELLANEOUS DETAILS - 1	
G-07	MISCELLANEOUS DETAILS - 2	
G-08	MISCELLANEOUS DETAILS - 3	
G-09	MISCELLANEOUS DETAILS - 4	

### LEGEND

	FENCE LINE
	ROW/PROPERTY LINE
	OU2 BOUNDARY
	CONTOUR
	TREE/BRUSH
	WETLANDS
	INLET
	HYDRANT
	CATCH BASIN
	WATER VALVE
	WATER MARKER
	POWER POLE
	MANHOLE
	CLEANOUT
	WATER LINE
	GAS LINE
	OVERHEAD ELECTRIC
	STORM


## ABBREVIATIONS

ELEC	ELECTRIC
WV	WATERVALVE
F.F.	FINISHED FLOOR
CONC.	CONCRETE
FH	FIRE HYDRANT
P/P	POWER POLE
ELEV.	ELEVATION
WM	WATER MARKER
RCV	REINFORCED CONCRETE PIPE
INVP	INVERT
GR	GRADE
GUY	GUY WIRE
CDA	CAPACITOR DISPOSAL AREA



**U.S. Army Corps  
of Engineers  
KANSAS CITY DISTRICT**

[illegible]

 <b>U.S. ARMY CORPS OF ENGINEERS</b> <b>KANSAS CITY DISTRICT</b> <b>KANSAS CITY, MISSOURI</b>	<b>ARCADIS-US, INC.</b> <b>44 SOUTH BROADWAY, 15th FLOOR</b> <b>WHITE PLAINS, NEW YORK 10601</b>		<b>ARCADIS</b>		<b>G02-4553G002.DWG</b>
	Designed by:	Date:	Drawn by:	Date:	
	MIN		CD		
	Reviewed by:	Date:	BG		
Approved by:		Date:			

**INDEX OF DRAWINGS, LEGEND,  
ABBREVIATIONS & GENERAL NOTES**

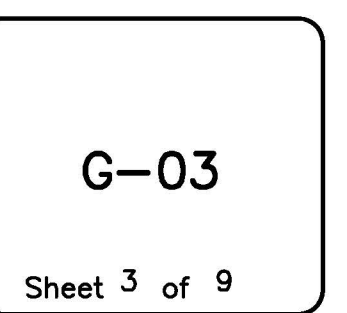
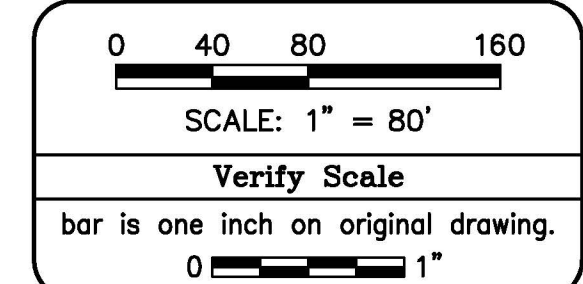
G-02

Sheet 2 of 9

# RECORD DRAWINGS

This drawing reflects changes made from the original contract drawing that were made during construction and has been prepared from information provided to the Engineer by the construction contractor (s). The Engineer does not warrant this drawing to be complete and accurate in all respects.

Date 9/13 By LB / ARCADIS



6543

2

1

## LEGEND

74	-	ELEVATION OF BOTTOM OF EXCAVATION
74	-	CLEAN FILL FROM CDA EXCAVATION ENCOUNTERED, NO SIDEWALL SAMPLES COLLECTED
GR	-	SAMPLES OBTAINED CLOSE TO GRADE
RR	-	SAMPLES ON CONRAIL PROPERTY - NO ELEVATIONS MAXIMUM 4 FOOT EXCAVATION
TP	-	TEST PIT SAMPLES
MT	-	LTDD TREATMENT PAD AREA - POST REMOVAL SAMPLES
BR	-	BEDROCK, NO FLOOR SAMPLES OBTAINED
CDA	-	EXCAVATED UNDER SEPARATE CONTRACT. ELEVATIONS ARE LOCATED IN THE OU2 CDA RA REPORT (2009)

**NOTE:**

1. REMEDIAL EXCAVATION BOTTOM AND PERIMETER SIDEWALL  
CONFIRMATORY SAMPLE RESULTS ARE LOCATED IN AN  
APPENDIX OF THE OU2 SOILS RA REPORT.
- \* CONFIRMATORY SAMPLES ASSOCIATED WITH THESE GRIDS  
ARE IDENTIFIED IN THE BACKFILL/CROSS SECTION DOCUMENTS  
INCLUDED IN AN APPENDIX OF THE OU2 SOILS RA REPORT.

## RECORD DRAWINGS

This drawing reflects changes made from the original contract drawing that were made during construction and has been prepared from information provided to the Engineer by the construction contractor (s). The Engineer does not warrant this drawing to be complete and accurate in all respects.

Date 9/13 By LB / ARCADIS



	RECORD DRAWINGS	9/13	CTD
1			
Symbl	Description	Date	Approved

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	BC			
	Drawn by:	Date:	File Name:	
	CD			
	Reviewed by:	Date:		
CD		G05-4553G005.DWG		

**U.S. ARMY ENGINEER DIVISION  
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KANSAS CITY DISTRICT  
KANSAS CITY, MISSOURI**

**ARCADIS**  
ARCADIS-US, INC.  
44 SOUTH BROADWAY, 15th FLOOR  
WHITE PLAINS, NEW YORK 10601

CORNELL-DUBILIER ELECTRONICS  
SUPERFUND SITE OU2 SOILS REMEDIATION  
SOUTH PLAINFIELD, NEW JERSEY

**SUPPLEMENTAL REMEDIAL  
INFORMATION:  
SAMPLE LOCATIONS AND  
EXCAVATION BOTTOM ELEVATIONS**

**G-04**

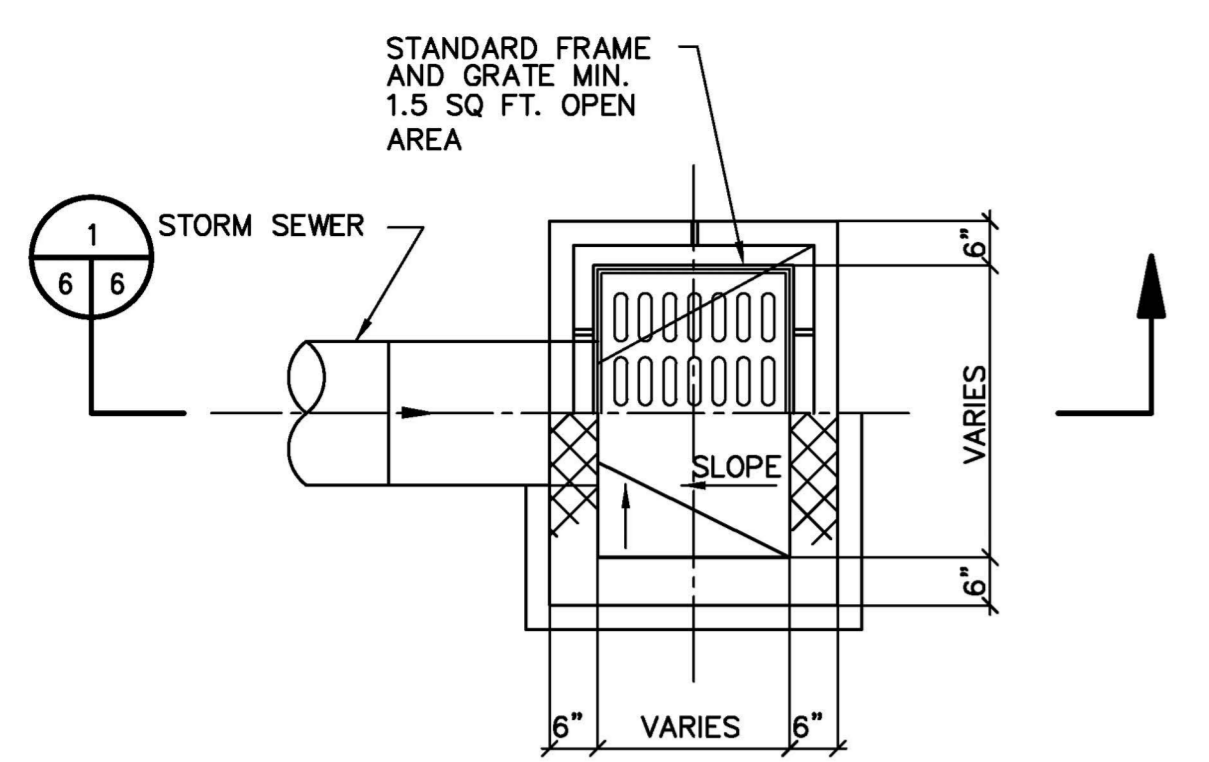
Sheet 4 of 9



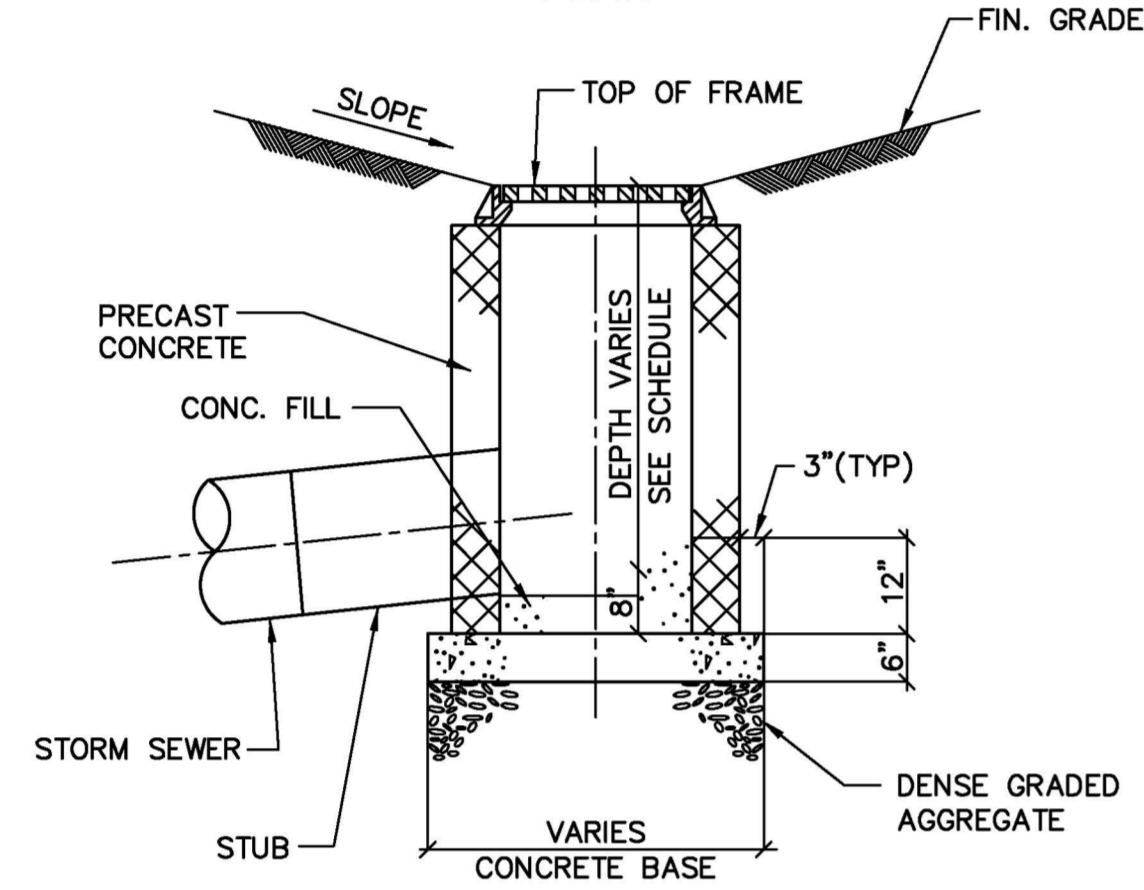
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A B C D E F G H

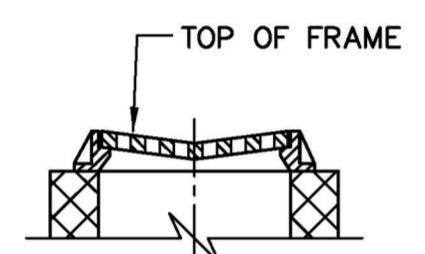
6  
5  
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1



PLAN



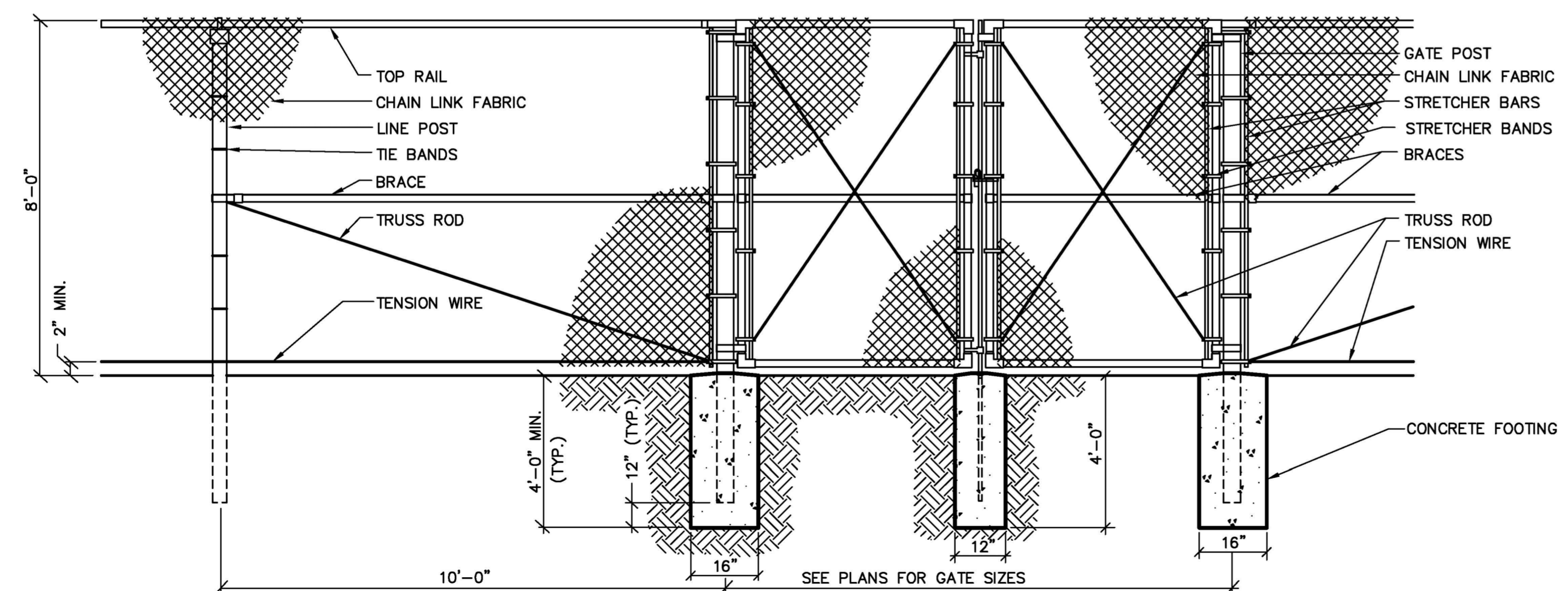
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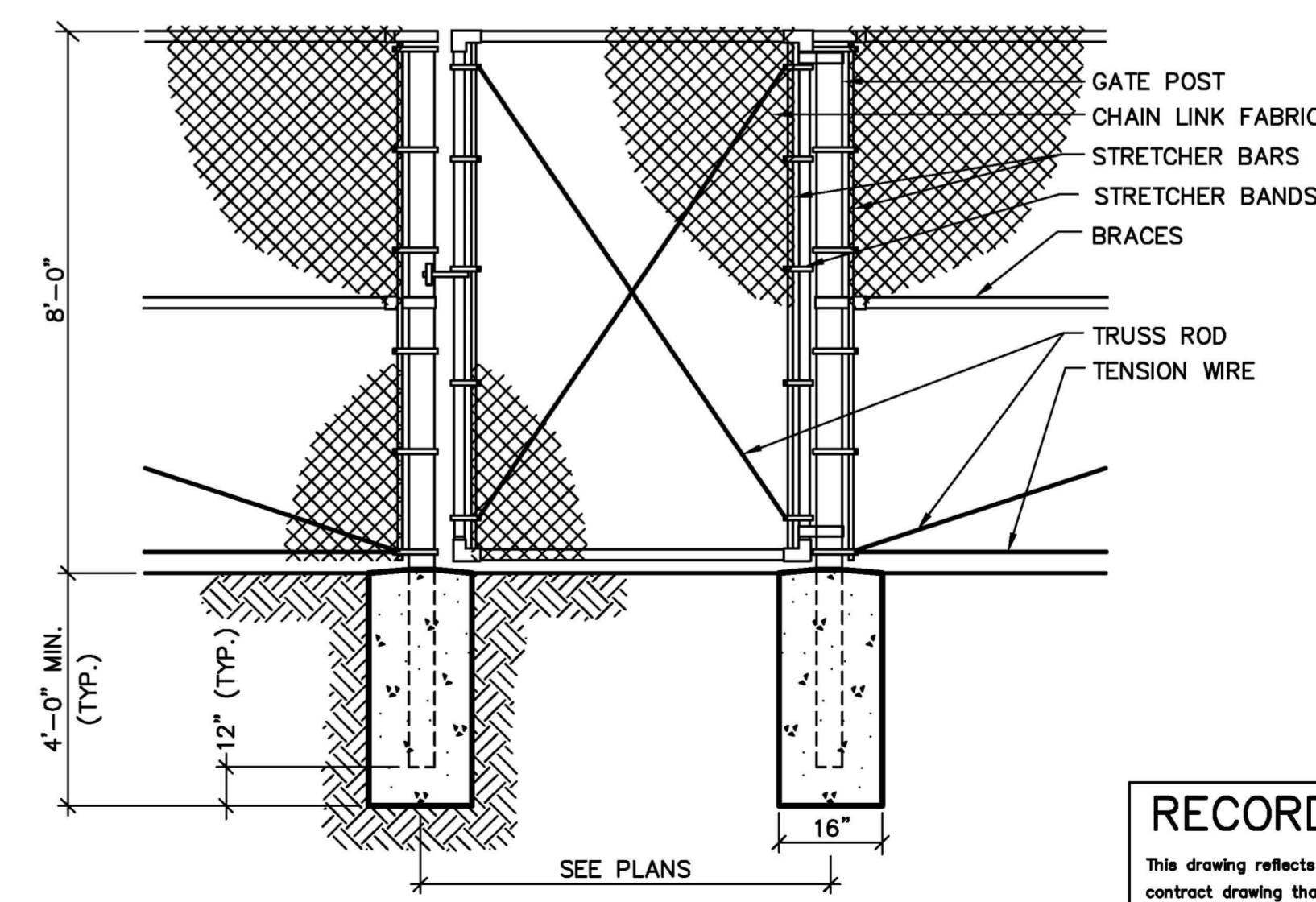
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SECTION 

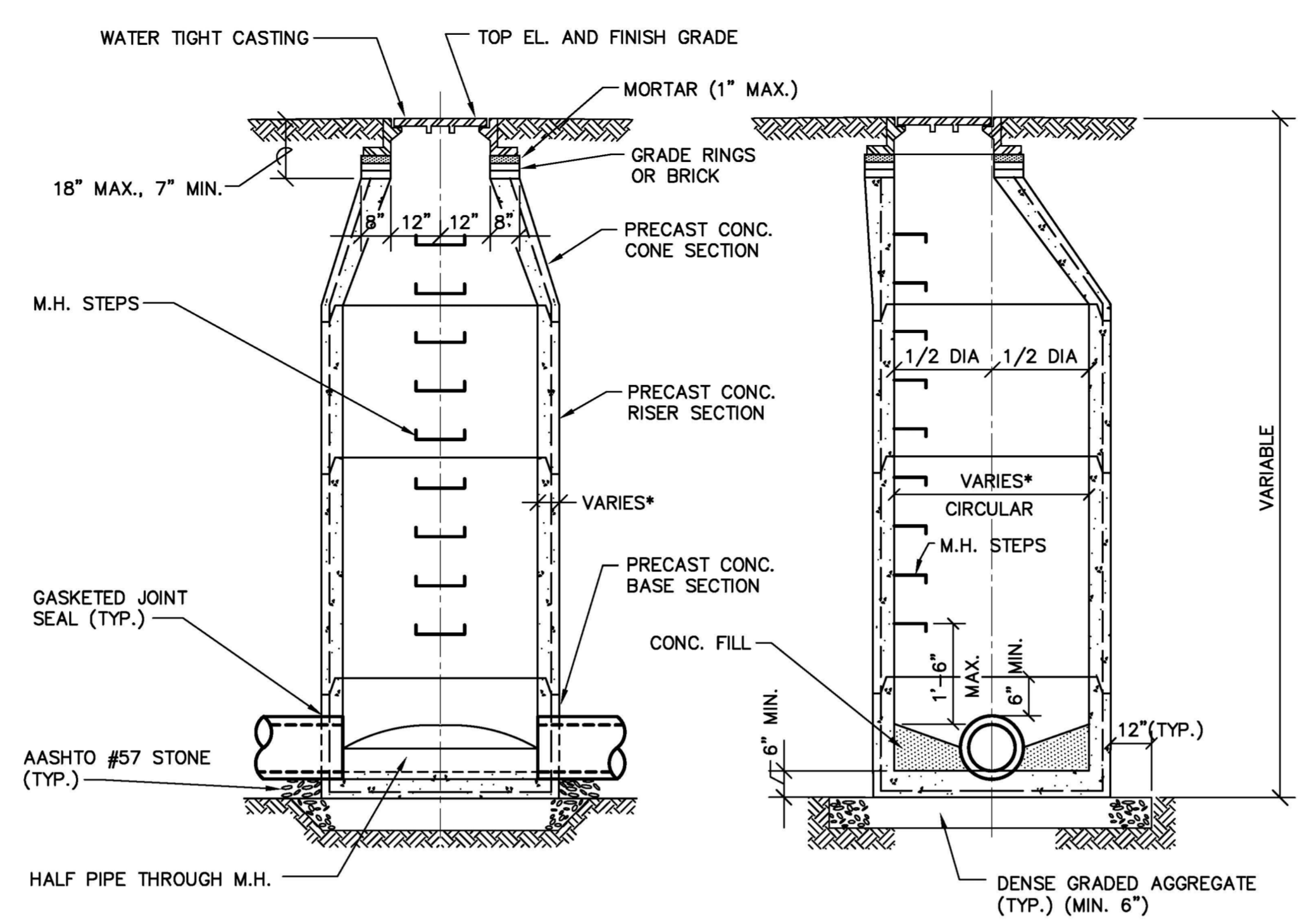
CATCH BASIN DETAIL  
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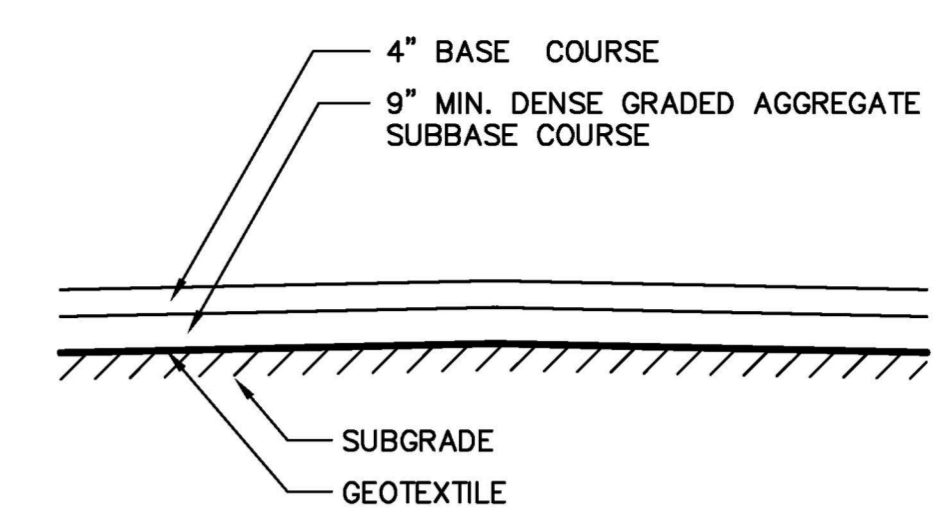
DOUBLE GATE DETAIL  
NOT TO SCALE



SINGLE GATE DETAIL  
NOT TO SCALE



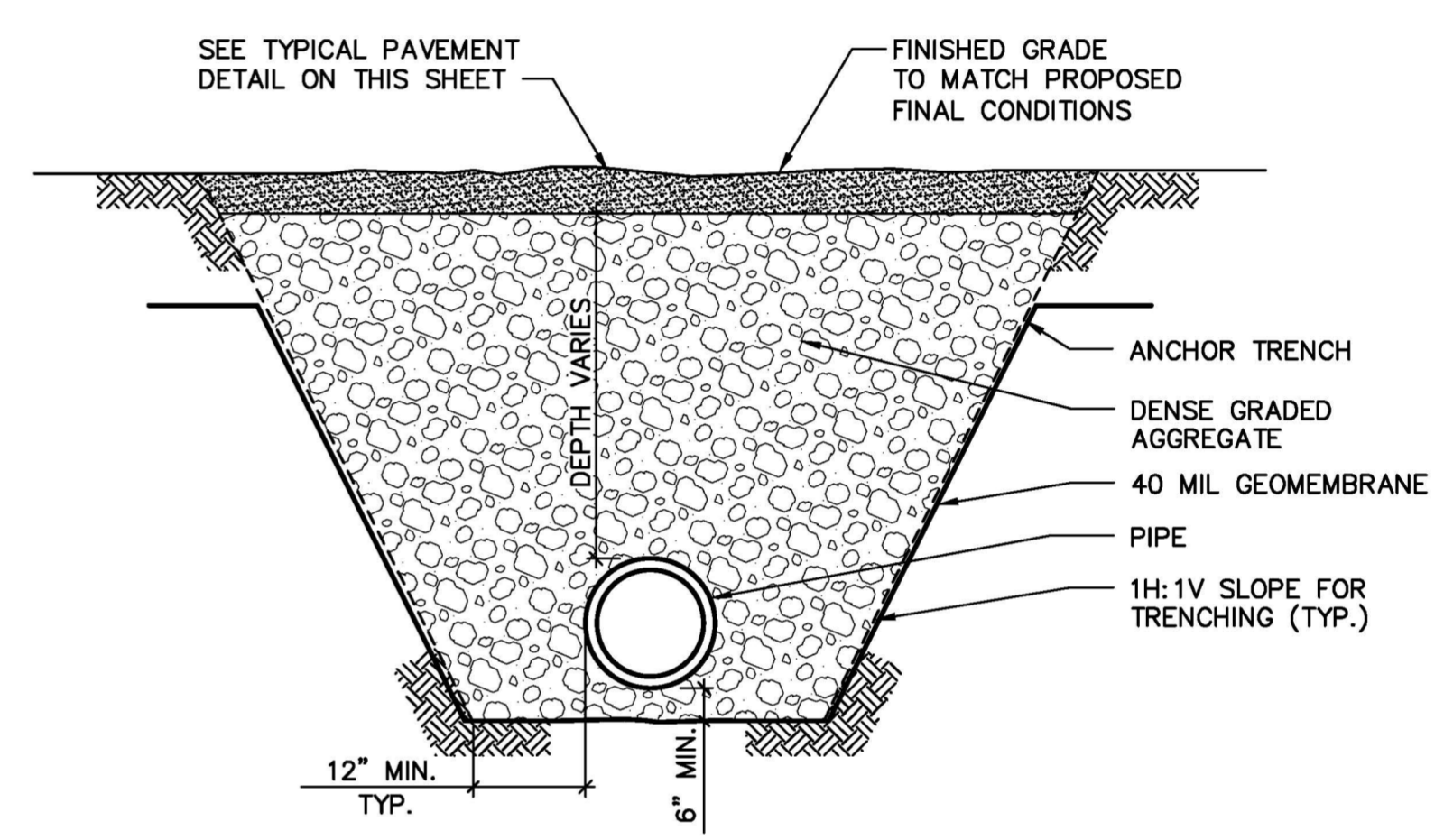
STORM WATER MANHOLE DETAIL  
NOT TO SCALE



TYPICAL PAVEMENT DETAIL

NOT TO SCALE

- NOTE:
1. ALL PAVEMENT MATERIAL AND INSTALLATION WAS BE IN ACCORDANCE WITH NJDOT.
  2. PAVEMENT SLOPE VARIED, SEE NOTE 1 ON SHEET G-03.



"CLEAN" UTILITY TRENCH DETAIL  
NOT TO SCALE

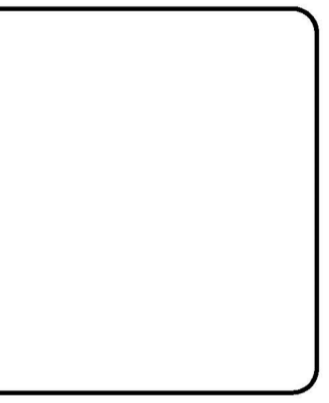
**RECORD DRAWINGS**

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Date 9/13 By LB / ARCADIS



RECORD DRAWINGS		Revisions	
1	9/13	Symbol	Date
		Description	Approved



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Drawn by:	Reviewed by:	Date:	
CD	BG		

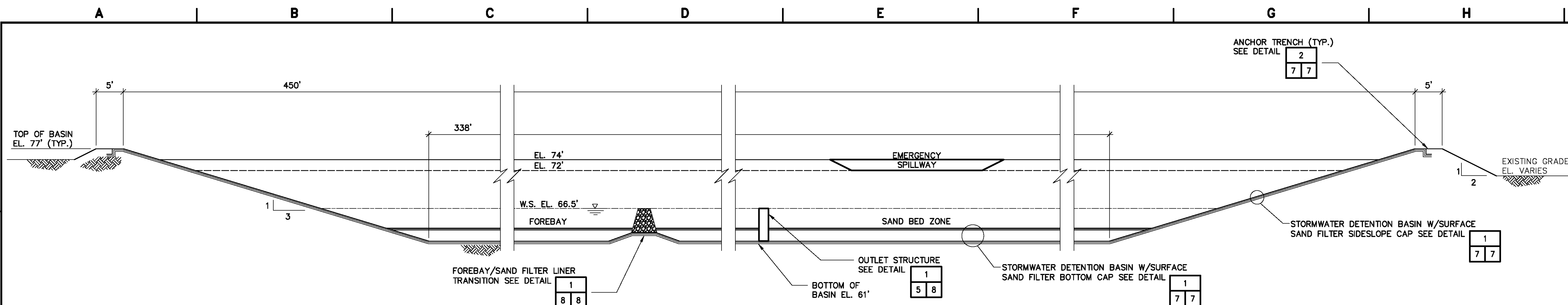
U.S. ARMY ENGINEER DIVISION  
CORPS OF ENGINEERS  
KANSAS CITY DISTRICT  
KANSAS CITY, MISSOURI

ARCADIS  
44 SOUTH BROADWAY, 15th FLOOR  
WHITE PLAINS, NEW YORK 10601

CORNELL-DUBILIER ELECTRONICS  
SUPERFUND SITE 002 SOILS REMEDIATION  
SOUTH PLAINFIELD, NEW JERSEY

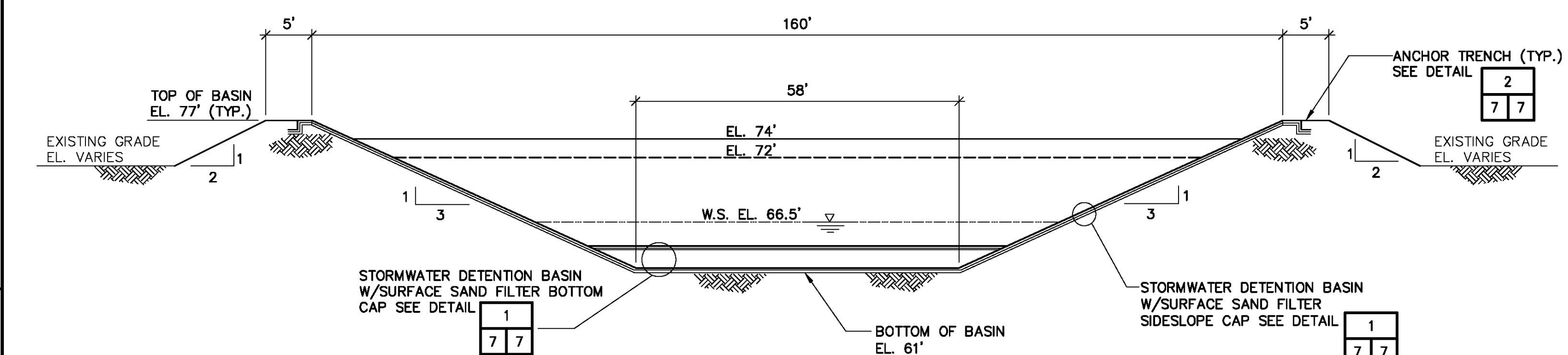
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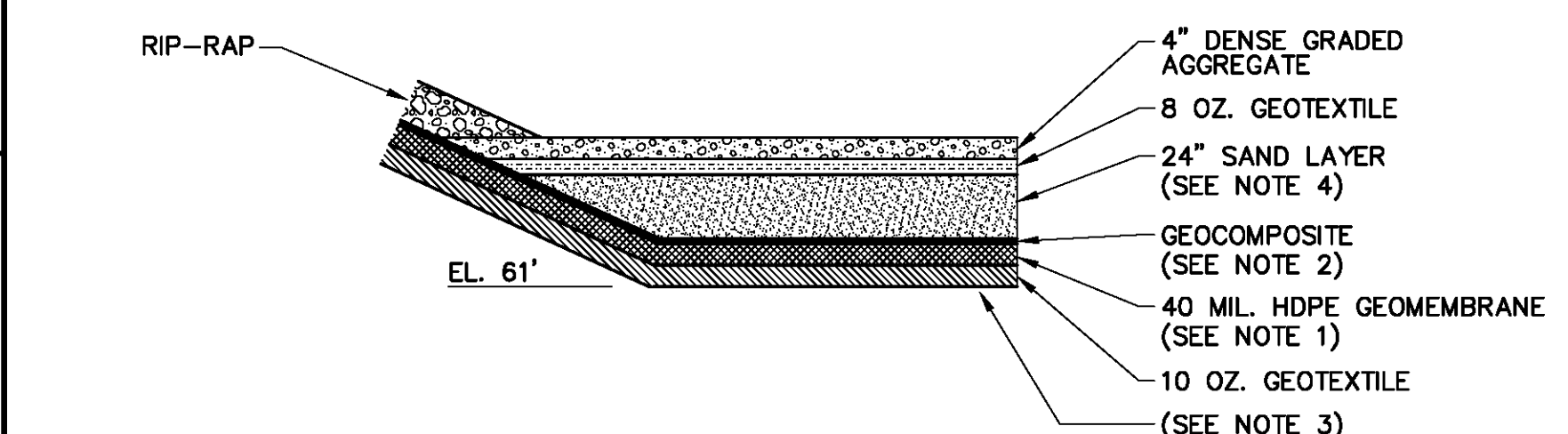
STORMWATER DETENTION BASIN W/SURFACE SAND FILTER

SECTION 1/5/7  
NOT TO SCALE



STORMWATER DETENTION BASIN W/SURFACE SAND FILTER

SECTION 2/5/7  
NOT TO SCALE



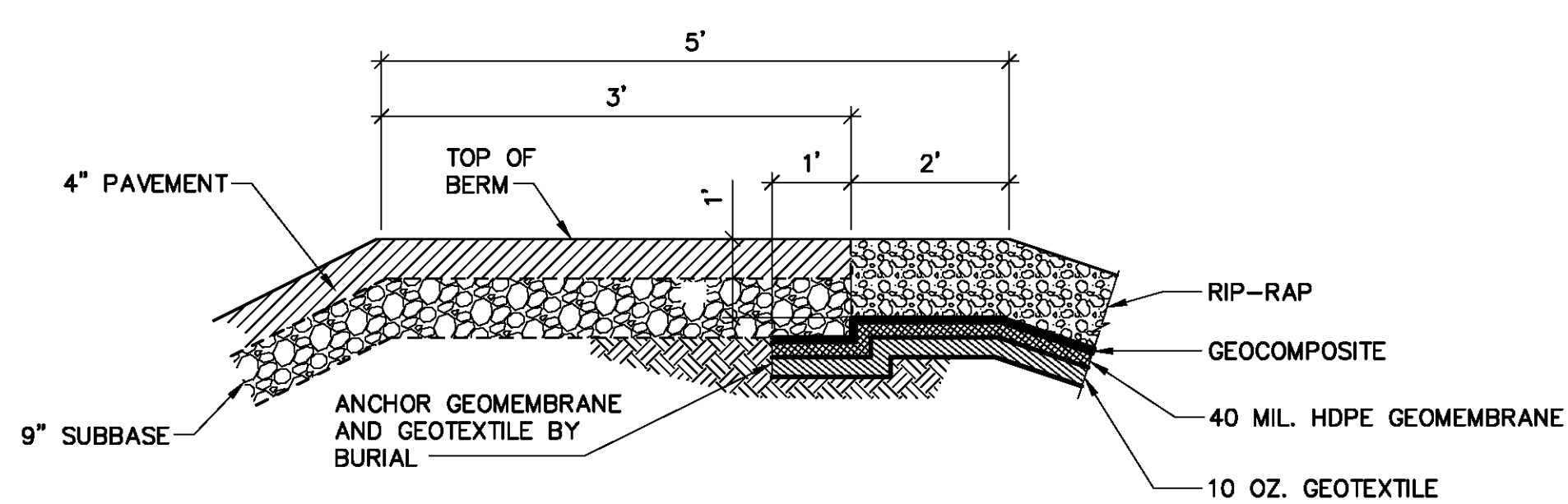
STORMWATER DETENTION BASIN W/SURFACE SAND FILTER  
SIDESLOPE AND BOTTOM CAP DETAIL

NOT TO SCALE

1/7/7

NOTES:

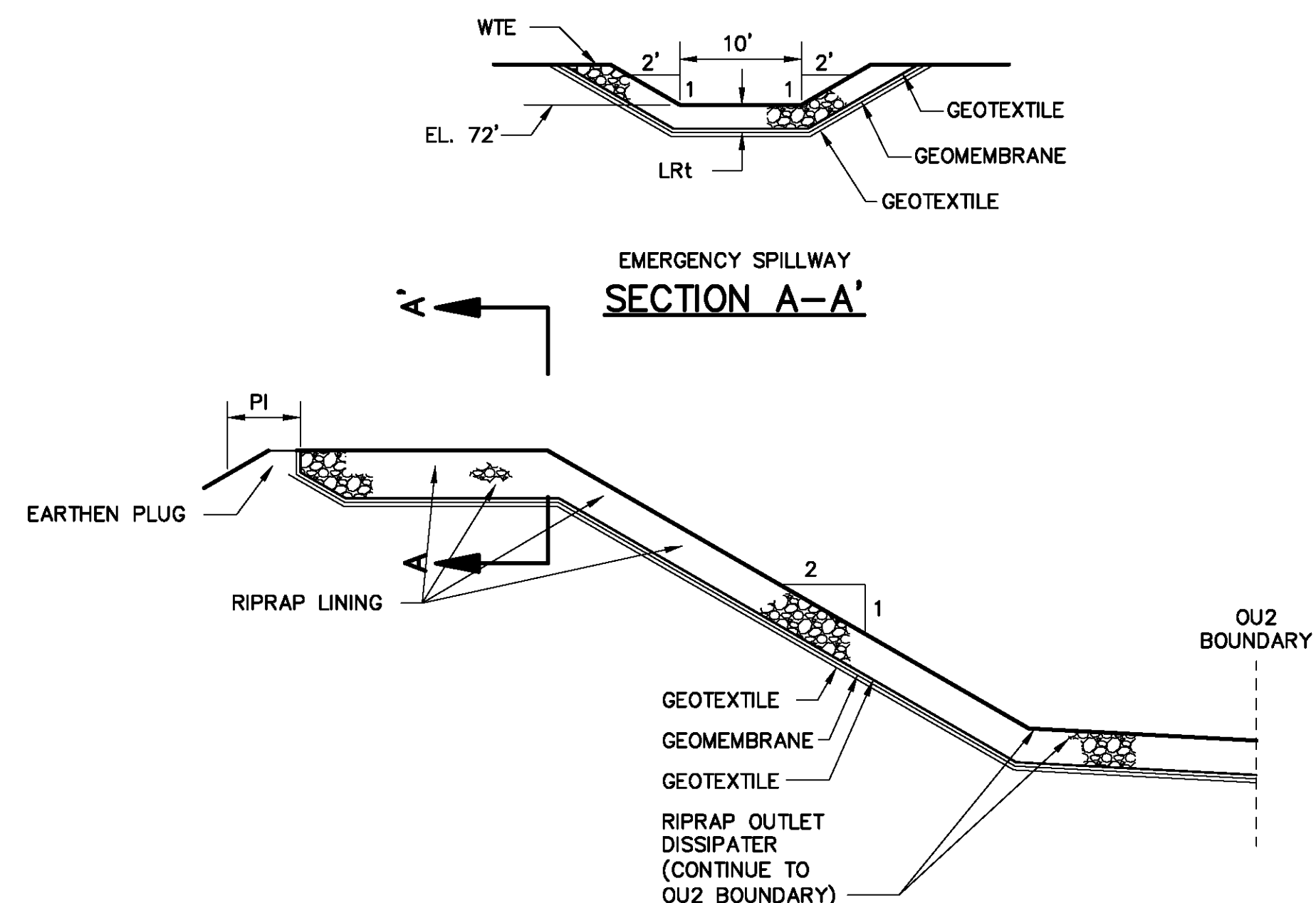
- SMOOTH GEOMEMBRANE INSTALLED ON BASIN BOTTOM, AND TEXTURED GEOMEMBRANE ON SIDESLOPES.
- GEOCOMPOSITE HAS A MINIMUM TRANSMISSIVITY OF  $1 \times 10^{-10} \text{ m}^2/\text{SEC}^4$  AS MEASURED USING WATER AT 20°C AT A GRADIENT OF 0.1, UNDER CONFINING PRESSURE OF 10,000 PSF, BETWEEN STAINLESS STEEL PLATES, AND HAS MINIMUM 6 OZ. NON-WOVEN GEOTEXTILE BONDED TO BOTH SIDES OF THE HDPE GEONET CORE.
- A SAND LEVELING LAYER ADDED WHEN BEDROCK WAS EXCAVATED TO ESTABLISH A SMOOTH SURFACE ON WHICH TO DEPLOY THE GEOSYNTHETICS.
- SAND LAYER WITHIN THE SAND BED ZONE MEETS THE SPECIFICATIONS FOR CLEAN MEDIUM AGGREGATE CONCRETE SAND IN ACCORDANCE WITH AASHTO M-6 OR ASTM C-33. SAND WITHIN THE FOREBAY ZONES IS CLEAN SAND FREE OF ORGANIC MATERIAL AS APPROVED BY THE ENGINEER.



ANCHOR TRENCH DETAIL

NOT TO SCALE

2/7/7



EMERGENCY SPILLWAY DETAIL

NOT TO SCALE

3/5/7

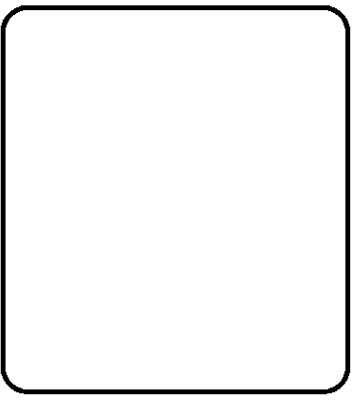
RECORD DRAWINGS

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Date 9/13 By LB / ARCADIS



RECORD DRAWINGS		Revisions	
CD	9/13	Date	Approved
1			



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Drawn by:	Date:	Reviewed by:	Date:	
CD		BG		

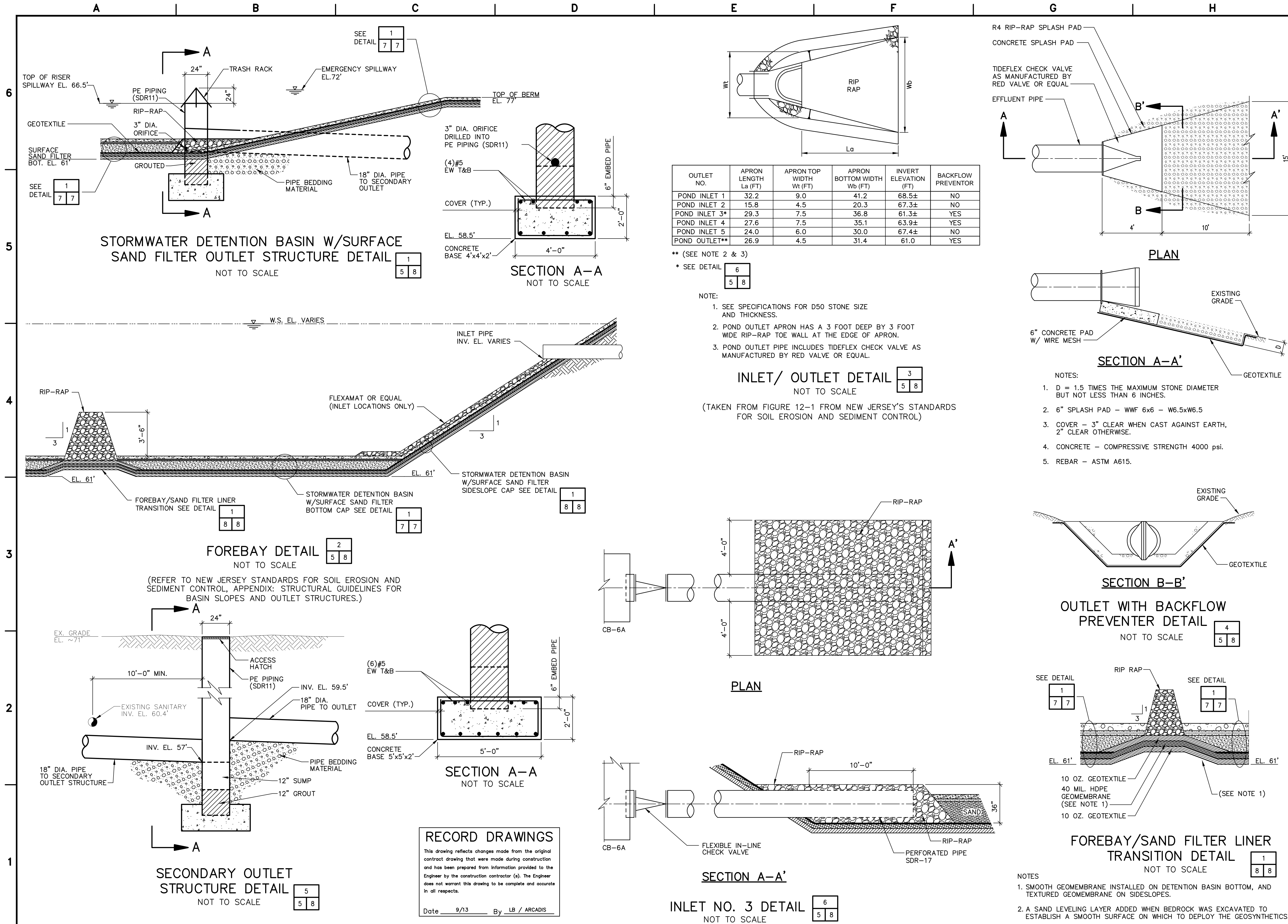
U.S. ARMY ENGINEER DIVISION  
CORPS OF ENGINEERS  
KANSAS CITY DISTRICT  
KANSAS CITY, MISSOURI  
44 SOUTH BROADWAY, 15TH FLOOR  
WHITE PLAINS, NEW YORK 10601  
ARCADIS

CORNELL-DUBILIER ELECTRONICS  
SUPERFUND SITE OU2 SOILS REMEDIATION  
SOUTH PLAINFIELD, NEW JERSEY  
MISCELLANEOUS DETAILS - 2

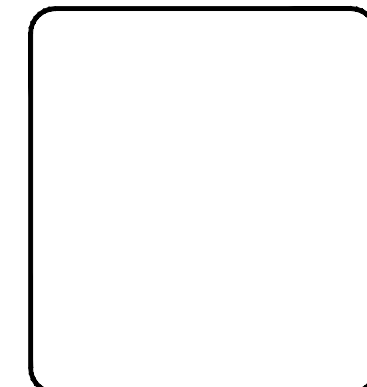
G-07

Sheet 7 of 9

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RECORD DRAWINGS		Revisions	
CTD	9/13	Description	Approved
1			



Designed by:	Date:	Approved by:	Date:	File Name:
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Drawn by:	Date:	Reviewed by:	Date:	
CD		BG		

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KANSAS CITY DISTRICT  
KANSAS CITY, MISSOURI

ARCADIS  
44 SOUTH BROADWAY, 15TH FLOOR  
WHITE PLAINS, NEW YORK 10601

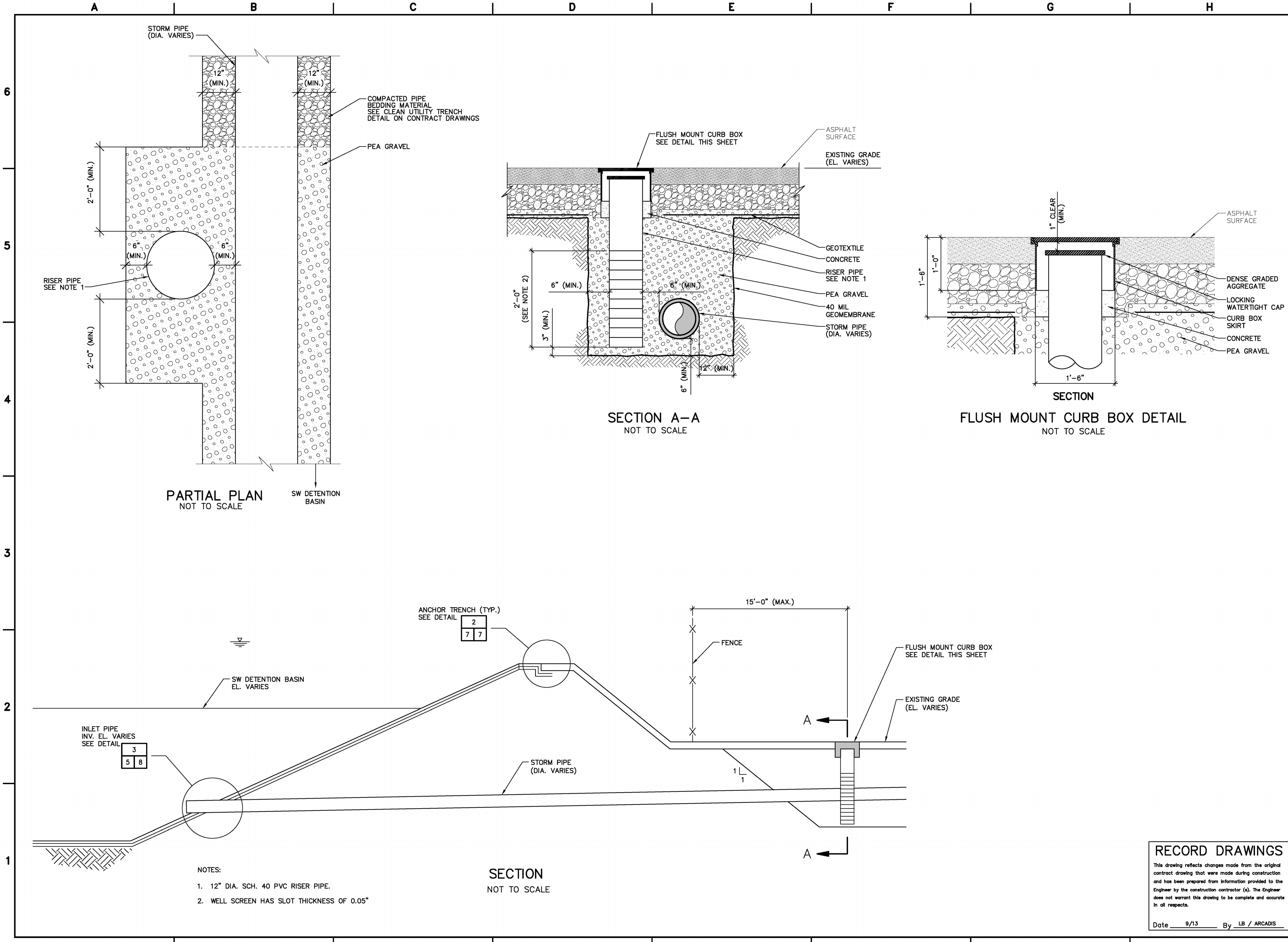
CORNELL-DUBILIER ELECTRONICS  
SUPERFUND SITE O2 SOILS REMEDIATION  
SOUTH PLAINFIELD, NEW JERSEY

MISCELLANEOUS DETAILS - 3

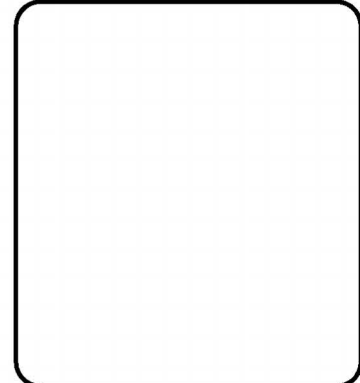
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Sheet 8 of 9

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1	Symbol	Description	Date	Approved	Date	Approved	Date



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Drawn by: CD	Date:	Reviewed by:	Date:	

U.S. ARMY ENGINEER DIVISION  
CORPS OF ENGINEERS  
KANSAS CITY DISTRICT  
KANSAS CITY, MISSOURI

ARCADIS

4553-105, 106  
44 SOUTH BROADWAY, 15th FLOOR  
WHITE PLAINS, NEW YORK 10601

CORNELL-DUBILIER ELECTRONICS  
SUPERFUND SITE OJZ SOILS REMEDIATION  
SOUTH PLAINFIELD, NEW JERSEY

MISCELLANEOUS DETAILS - 4

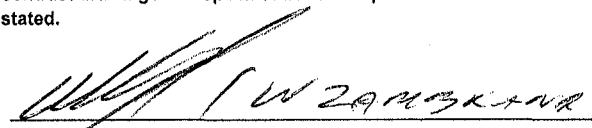
G-09

Sheet 9 of 9

**RECORD DRAWINGS**

This drawing reflects changes made from the original contract drawing that were made during construction and has been prepared from information provided to the Engineer by the construction contractor (s). The Engineer does not warrant this drawing to be complete and accurate in all respects.

Date 9/13 By LB / ARCADIS

<b>TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE</b> <small>(Read instructions on the reverse side prior to initiating this form)</small>				DATE 01/12/2009		TRANSMITTAL NO. 02310-5.1		
<b>SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS</b> <small>(This section will be initiated by the contractor)</small>								
TO: Environmental Residency US Army Corps of Engineers 214 State Highway 18 East Brunswick, NJ 08816			FROM: Severson Environmental Services Inc. 2749 Lockport Road Niagara Falls, NY 14305		CONTRACT NO. W912DQ-04-D-0023 0011		CHECK ONE: <input checked="" type="checkbox"/> THIS IS A NEW TRANSMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL _____	
SPECIFICATION SEC. NO. (Cover only one section with each transmittal) 02310			PROJECT TITLE AND LOCATION Cornell Dubilier OU2 Soils (LTDD) 333 Hamilton Boulevard, SP, NJ 07080				CHECK ONE: THIS TRANSMITTAL IS FOR <input type="checkbox"/> FIO <input checked="" type="checkbox"/> GA <input type="checkbox"/> DA <input type="checkbox"/> CR	
ITEM NO.  a.	DESCRIPTION OF ITEM SUBMITTED (Type size, model number/etc.)  b.	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See instruction no. 8)  c.	NO. OF COPIES  d.	CONTRACT REFERENCE DOCUMENT  SPEC. PARA. NO.      DRAWING SHEET NO. e.                                  f.		FOR CONTRACTOR USE CODE  g.	VARIATION (See Instruction No. 6)  h.	FOR CE USE CODE  i.
4	Dewatering Work Plan Revision 1	WORK PLAN	6	1.3		A	N	
REMARKS				I certify that the above submitted items have been reviewed in detail and are correct and in the strict conformance with the contract drawings and specifications except as otherwise stated.   NAME AND SIGNATURE OF CONTRACTOR				
<b>SECTION II - APPROVAL ACTION</b>								
ENCLOSURES RETURNED (List by item No.)			NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY				DATE	

**Comments Matrix – Dewatering Work Plan (Transmittal No. 02310-5)**  
**Cornell-Dubilier Electronics Superfund Site - Operable Unit 2 – Soils Remediation**  
**Contractor – Severson Environmental Services, Inc.**  
**Reviewer – Malcolm Pirnie, Inc.**

Reviewer Comment No	Page /Para	Section	Comment	Response
1	NA	General	<p>Specification Section 02310, Paragraph 3.2.2.1 indicates that the maximum allowable excavation open at any time shall be limited to 5 acres. Confirm the maximum excavation opening in this plan.</p> <p>Since the amount of dewatering due to precipitation has a direct relationship with the size of the open excavation area, the Contractor is encouraged to jointly determine with the Contracting Officer a maximum excavation area less than 5 acres as indicated in this same specification paragraph.</p>	<u>A new section title “Open Excavation” has been added to page 1</u>
2	NA	General	Specification Section 02310, Paragraph 3.2.2.1 requires that the water level be maintained at or below the excavation bottom at all times for open excavations, and that weekly performance records will be submitted. Please confirm that this will take place.	<u>A new section title “Open Excavation” has been added to page 1</u>

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# **Dewatering Work Plan**

## **Revision 1**

**Cornell - Dubilier Electronics Superfund Site  
Middlesex County, New Jersey**

Prepared For:

U.S. Army Corps of Engineers

USACE Contract Number - W912DQ-04-D-0023

Task Order - 0011

Operating Unit 2 Soils (LTDD)

Prepared By:

Sevenson Environmental Services, Inc.

2749 Lockport Road

Niagara Falls, New York 14305

January 12, 2009

## DEWATERING PLAN

order to maintain the integrity of the in site material. While the excavation is open, the water level shall be maintained at or below the bottom of the excavation at all times. An open excavation checklist will be maintained by SES SSHO and will be submitted weekly when there is any open excavation.

### **V Water Treatment**

Sevenson anticipates collecting water in 21,000-gallon "Frac" tanks. As the tank gets full, the water will be sampled and analyzed, and sent off site for disposal. Sevenson will collect the water in Frac tanks; perform sampling and analysis of the collected water, and dispose of the water offsite at an approved disposal facility.

## DEWATERING PLAN

### I. DEWATERING PLAN OBJECTIVES

The purpose of the Dewatering Plan is to present the methods and procedures for handling, storage, treatment, and disposal of excavation derived water. Severson will be responsible for completing the work in accordance with Federal, State and local regulatory requirements.

### II Surface Water Control

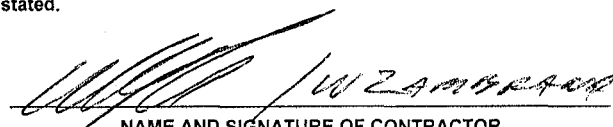
Severson will install berms, swales, and other measures necessary to prevent surface water from entering and exiting excavations. Surface water will be directed away from excavation and construction sites so as to prevent erosion and undermining of foundations and to prevent surface water run on from becoming contaminated by accumulating in excavations. Asphalt berms will be utilized to divert water on asphalt surfaces. All diverted water will be directed to existing drain ways and storm sewer systems so as to not flood adjacent structures or properties. Backfill surfaces will be protected to prevent erosion and sloughing. Other measures include covering the excavated area with polyethylene so that clean water is diverted from the excavation will be utilized.

### III Water Handling

Pumping of water from excavation will be conducted in such a manner as to preserve the undisturbed bearing capacity of the sub-grade soils at the excavation. Well or sump installations will be constructed with sand/stone filters to prevent drawing of finer grained soil from the surrounding ground. Pumping will be performed from these sumps/wells. A pump with a discharge hose will be utilized to pump water from excavations to an on-site storage tank. Portable polyethylene (poly) storage tanks will be use to collect water from remote areas. The poly tank will be transported by rubber tire backhoe to the storage tank. The contents from the poly tank will be pumped into the storage tank.

### IV Open Excavation

Severson shall minimize area of open excavation so as to limit the volume of dewatering required for the project. The maximum allowable excavation open at any time shall be limited to 5 acres maximum and jointly determined by the Contracting Officer and Severson. Since the amount of dewatering due to precipitation has a direct relationship with the size of the open excavation area, Severson will determine with the Contracting Officer a maximum excavation area less than 5 acres by utilizing backfill and covering the excavated area with polyethylene so that clean water is diverted from the excavation. Control measures shall be taken by the time the excavation reaches the water level in

<b>TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE</b> <small>(Read instructions on the reverse side prior to initiating this form)</small>				DATE 01/12/2009		TRANSMITTAL NO. 01351-1.1		
<b>SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS</b> <small>(This section will be initiated by the contractor)</small>								
TO: Environmental Residency US Army Corps of Engineers 214 State Highway 18 East Brunswick, NJ 08816			FROM: Severson Environmental Services Inc. 2749 Lockport Road Niagara Falls, NY 14305		CONTRACT NO. W912DQ-04-D-0023 0011		CHECK ONE: <input checked="" type="checkbox"/> THIS IS A NEW TRANSMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL _____	
SPECIFICATION SEC. NO. (Cover only one section with each transmittal) 01351			PROJECT TITLE AND LOCATION Cornell Dubilier OU2 Soils (LTTD) 333 Hamilton Boulevard, SP, NJ 07080			CHECK ONE: THIS TRANSMITTAL IS FOR <input type="checkbox"/> FIO <input checked="" type="checkbox"/> GA <input type="checkbox"/> DA <input type="checkbox"/> CR		
ITEM NO.  a.	DESCRIPTION OF ITEM SUBMITTED (Type size, model number/etc.)  b.	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See instruction no. 8)  c.	NO. OF COPIES  d.	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE  g.	VARIATION (See Instruction No. 6)  h.	FOR CE USE CODE  i.
				SPEC. PARA. NO.  e.	DRAWING SHEET NO.  f.			
4	Dust Control Plan Revision 1	WORK PLAN	6	1.3		A	N	
REMARKS				I certify that the above submitted items have been reviewed in detail and are correct and in the strict conformance with the contract drawings and specifications except as otherwise stated.   NAME AND SIGNATURE OF CONTRACTOR				
<b>SECTION II - APPROVAL ACTION</b>								
ENCLOSURES RETURNED (List by item No.)			NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY			DATE		

# **Dust Control Plan**

## **Revision 1**

**Cornell - Dubilier Electronics Superfund Site  
Middlesex County, New Jersey**

Prepared For:

U.S. Army Corps of Engineers

USACE Contract Number - W912DQ-04-D-0023

Task Order - 0011

Operating Unit 2 Soils (LTDD)

Prepared By:

Sevenson Environmental Services, Inc.

2749 Lockport Road

Niagara Falls, New York 14305

January 12, 2009

**Comments Matrix – Dust Control Plan (Transmittal No 01351-1)**  
**Cornell-Dubilier Electronics Superfund Site - Operable Unit 2 – Soils Remediation**  
**Contractor – Severson Environmental Services, Inc.**  
**Reviewer – Malcolm Pirnie, Inc.**

<b>Reviewer Comment No</b>	<b>Page /Para</b>	<b>Section</b>	<b>Comment</b>	<b>Response</b>
1	2	<b>III Dust Control and Mitigation Procedures - Mobilization</b>	Specification Section 01351.c Paragraph 1.38 requires that trucks carrying debris shall have a double locking mechanism on the tailgates. Please add this requirement to this section.	<u>This has been added to Page 2</u>
2	7	<b>Monitoring and Corrective Action</b>	Specification Section 01351, paragraph 1.38.a requires real-time airborne monitoring equipment to be utilized. Additional requirements can also be found in Paragraph 1.15.2. Revise this section to include the real time air monitoring requirements.	<u>This has been added to Page 7 and 8</u>
3	NA	<b>General</b>	The plan indicates in various places that water suppression will be utilized for dust control. Is there a plan to have a water truck on-site at all times? Where will the water be obtained from? How will resulting runoff water be controlled to prevent infiltration into open excavations?	<u>This has been updated and added to page 4</u>

## Dust Control Plan

### I. INTRODUCTION

This Dust Control Plan (DCP) has been prepared by Severson Environmental Services, Inc. (Severson) to address the control of fugitive and airborne dust emissions from the Cornell Dubilier Electronics Superfund Site (the Site) located in South Plainfield, New Jersey. This Plan complies with the State of New Jersey rules for controlling fugitive dust emissions as specified in Contract Specification Section 01351. The primary objective of this plan is to formulate a strategy for controlling, to the greatest extent practicable, fugitive or airborne dust emissions at the Site. This will be accomplished by identifying specific sources and activities that have the highest potential to produce or generate fugitive or airborne dust emissions. This plan describes the engineering controls necessary to minimize and control dust emissions from those sources and activities. This plan is prepared to address the control of fugitive dust emissions at the Site that are a result of current remediation activities. As necessary, the scope of this plan will be revised to reflect changes in Severson's dust control strategy as site conditions or activities may change in the future.

The Cornell Dubilier Electronics Superfund Site (Site), Operable Unit 02 (OU-2), is located at 333 Hamilton Boulevard in the Borough of South Plainfield, Middlesex County, New Jersey. Work under OU-2 includes excavating soils and debris, screening excavated material, thermally treating screened material, transportation of wastes and offsite disposal of wastes including debris and oversized material resulting from the screen; restoration with backfill and pavement; and other activities necessary for the complete and proper remediation of the site.

As a precautionary and control measure for this project, this Dust Control Plan will be used as a standard operating procedure. This plan will be used:

- To eliminate origins of dust from the site;
- To identify potential dust migration pathways;

## Dust Control Plan

- To monitor for dust produced by site activities; and
- To implement corrective actions as the need arises.

This plan is not intended to address all situations as they may occur, however, the plan has attempted to include all foreseeable situations and planned work areas/activity tasks. In addition, the plan provides an approach to those situations that cannot be anticipated at the time of its preparation. The plan is prepared and submitted with the understanding that it can be modified to accommodate actual site conditions as they arise. This plan will be implemented in conjunction with the project Health and Safety Plan.

### II. POTENTIAL FUGITIVE DUST SOURCES

The materials of concern, with respect to fugitive dust emissions at the Site, are PCB's, VOC's and metals. Severson has identified the following project work areas/tasks as potential sources of fugitive dust emissions. They are as follows:

#### *MOBILIZATION*

During site mobilization, the following tasks will be performed, which have potential for producing dust:

- Grading and placing stone to prepare the support area;
- Grading and placing of stone to upgrade stabilized construction entrances;  
and
- Delivery of equipment and materials. Trucks carrying debris shall have a double locking mechanism on the tailgates.

#### *SITE PREPARATION*

The following site preparation activities may generate dust:

- Test pit excavations to locate utilities;

## Dust Control Plan

- Utility installations; and
- Installation of erosion and sediment controls.

### ***UTILITY DISCONNECTS/REMOVALS***

- Utility disconnects and removals (gas mains, water mains, sanitary and storm drains) may require the following excavations/activities with the potential to produce dust;
- Sidewalk excavation and removal;
- Pavement saw cutting and excavation;
- Utility trench excavation and backfill; and
- Sidewalk and street grading.

### ***CONTAMINATED SOIL EXCAVATION***

Excavation activities are likely to generate dust from the following:

- Asphalt saw cutting and removal;
- Soil excavation and loading;
- Soil Screening; and
- Soil transportation.

### ***WORK AREA RESTORATION AND DEMOBILIZATION***

After remedial activities are completed, the following operations will take place:

- Backfill to existing lines and grades;
- Pavement restoration; and
- Removal of equipment and temporary facilities.

## Dust Control Plan

### III. DUST CONTROL AND MITIGATION PROCEDURES

The following methods will be used to prevent conditions conducive to dust generation and suppress dust should it occur. The methods below are presented in accordance with project functions or specific work areas.

#### ***WORKER TRAINING AND PRACTICES***

- Educate, train and reinforce workers at daily safety meetings of the necessity to perform their tasks in a manner that does not generate dust;
- Stress the importance and reinforce the need to keep assigned work areas clean, neat, and dust-source free as a standard operational procedure during all work activities on an ongoing basis;
- Maintain dust suppression in assigned work areas; and
- Ensure that workers notify supervisors of dusty conditions whenever they are visually observed and request dust suppression support if needed.

#### ***MOBILIZATION***

- Insure trucks delivering materials (stone, gravel, etc.) are covered/tarped;
- Maintain access roads and regrade as required;
- Establish speed limits suitable to access roads to minimize fugitive dust;
- Routinely apply water to cover high traffic areas (haul roads and site access roads) with water spray from water truck that is located on-site or local hoses. This procedure will help prevent soil from accumulating on surfaces or from drying. Broom sweep asphalt roads after application of water. A main fire hydrant that is located inside the Industrial Park will be utilized to fill the Water truck or connect with hoses. Severson will install berms, swales, and other measures necessary to prevent water run-offs from entering and exiting excavations. Water will be directed away from excavation and construction sites so as to prevent erosion and

## Dust Control Plan

undermining of foundations and to prevent surface water run on from becoming contaminated by accumulating in excavations. Asphalt berms will be utilized to divert water on asphalt surfaces. All diverted water will be directed to existing drain ways and storm sewer systems so as to not flood adjacent structures or properties.

### ***SITE PREPARATION***

- Routinely apply water to the excavation area to dampen excavated materials. Care will be utilized to not saturate the material; and
- Routinely apply water to access roads, as necessary, with a water spray. Broom sweep asphalt road areas where water has been applied.

### ***UTILITY DISCONNECTS AND REMOVALS***

- Routinely apply water to the excavation to dampen excavated materials;
- Backfill trenches with clean fill material.

### ***PERSONNEL CONTAMINANT REDUCTION ZONE (CRZ)***

- Utilize proper decontamination procedures;
- Properly remove and containerize all PPE;
- Remove accumulated solids and debris within the CRZ;
- Maintain boot wash basins; and
- Perform daily housekeeping of the CRZ.

### ***EXCAVATION***

- Apply water mist/fog during excavating to minimize dust emissions;
- Routinely apply water to access roads;
- Establish speed limits to access roads to minimize fugitive dust;
- Routinely apply water to cover high traffic areas with water spray from water truck or local hoses to prevent clean soils from accumulating and drying;
- Place polyethylene on the ground surface where trucks are loaded;

## Dust Control Plan

- Material loaded into trucks should not be dropped from heights above the truck body;
- Broom sweep truck tires used to haul material off site prior to leaving the site.
- Immediately clean excavated material spilled on the ground surface and sweep the road as required;
- Routinely remove any material that accumulates around equipment and work areas;
- Cover stockpiled materials with polyethylene at the end of each workday as storage areas become full or during periods of high winds;
- Cover (tarp) loaded trucks; and

### ***WORK AREA RESTORATION AND DEMOBILIZATION***

- Routinely apply water to the utility excavation to dampen excavated materials;
- Routinely apply water to access roads with a water spray. Broom sweep asphalt road areas where water has been applied;
- Establish speed limits to minimize fugitive dust;
- Ensure delivery trucks (delivering backfill materials, etc.) are covered; and
- Routinely apply water to the backfill materials for moisture control.

### ***HEAVY EQUIPMENT DECONTAMINATION***

- Remove gross contamination with brooms, shovels, scrapers and brushes;
- Wash with spray washers, if needed;
- Rinse with power-washer or steam-jenny if brooming techniques fail; and
- Transfer accumulated solids to stockpile/disposal area.

## **IV. BEST MANAGEMENT PRACTICES**

The following Best Management Practices (BMPs) will also be followed to help minimize and control dust emissions at the Site to the greatest extent possible:

**Roads**—All onsite traffic will be restricted to specific designated roads. Off-road travel will only be authorized on a case-by-case basis. Traffic speed will also be restricted to an appropriate level

## Dust Control Plan

on all designated roads. All designated roads will be considered as high potential dust source areas, and as such, will be a priority for dust controls utilizing magnesium/calcium chloride, watering, or gravel.

**Hours of Operation**—This Plan will be in effect during all hours of operation at the Site. During non-business hours, there will be no activities generating dust; therefore, dust control actions will be restricted to hours of operation only. However, as a best management practice, if high winds are evident at the close of a business day (or immediately prior to a weekend, holiday, etc.), site personnel should evaluate vulnerable areas and implement controls as appropriate to minimize off-hours emissions.

**Use of Chemical Suppressants**—Use of various chemical dust suppressants (e.g., surfactants, salt-based soil conditioners, etc.) shall be done in accordance with the recommended end-uses for those products. Site personnel shall not exceed the manufacturer recommended application rates. Material Safety Data Sheets (MSDSs) for all dust suppressant materials used at the Site shall be reviewed and approved by USACE. Prior to application, site personnel shall determine and evaluate if the use of the dust suppressant could interfere with other site monitoring activities, or cause other harm to the environment (e.g., runoff into critical habitat for threatened or endangered fish). The MSDSs for dust suppressants will be kept on-site.

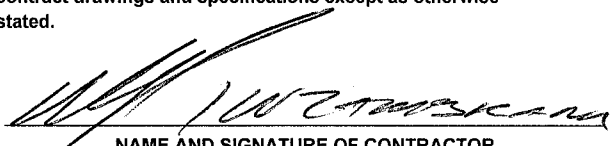
### V. MONITORING AND CORRECTIVE ACTION

Sevenson will implement all dust-monitoring/correction programs. Daily site safety meetings will reinforce the need for all workers to be cognizant and responsive to conditions or activities that generate visible dust. The area foreman and supervisors will be notified immediately if dust is observed or if conditions exist where dust could be a problem. SES will provide real-time monitoring for dust using a total airborne dust monitor (MIE-Ram-1 or equivalent) with data logging capabilities within 10 feet (downwind) at appropriate areas adjacent to excavation, soil stockpiling, screening, and pretreatment, fill placement and compaction. Perimeter dust monitoring shall be conducted at a minimum of four locations near the site perimeter alternating between the Lehigh Valley RR and Factory Street borders and the Spicer Avenue and Hamilton

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<b>TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE</b> <small>(Read instructions on the reverse side prior to initiating this form)</small>					DATE 02/10/2009		TRANSMITTAL NO. 02310-6.1	
<b>SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS</b> <small>(This section will be initiated by the contractor)</small>								
TO: Environmental Residency US Army Corps of Engineers 214 State Highway 18 East Brunswick, NJ 08816			FROM: Severson Environmental Services Inc. 2749 Lockport Road Niagara Falls, NY 14305		CONTRACT NO. W912DQ-04-D-0023 0011		CHECK ONE: <input checked="" type="checkbox"/> THIS IS A NEW TRANSMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL _____	
SPECIFICATION SEC. NO. (Cover only one section with each transmittal) 02310			PROJECT TITLE AND LOCATION Cornell Dubilier OU2 Soils (LTDD) 333 Hamilton Boulevard, SP, NJ 07080				CHECK ONE: THIS TRANSMITTAL IS FOR <input type="checkbox"/> FIO <input checked="" type="checkbox"/> GA <input type="checkbox"/> DA <input type="checkbox"/> CR	
ITEM NO.	DESCRIPTION OF ITEM SUBMITTED <small>(Type size, model number/etc.)</small>	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. <small>(See instruction no. 8)</small>	NO. OF COPIES	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE	VARIATION <small>(See Instruction No. 6)</small>	FOR CE USE CODE
a.	b.	c.	d.	SPEC. PARA. NO. e.	DRAWING SHEET NO. f.	g.	h.	i.
11	Excavation and Mat Handling Plan Rev 1	WORK PLAN	6	1.3		A	N	
REMARKS				I certify that the above submitted items have been reviewed in detail and are correct and in the strict conformance with the contract drawings and specifications except as otherwise stated.   NAME AND SIGNATURE OF CONTRACTOR				
<b>SECTION II - APPROVAL ACTION</b>								
ENCLOSURES RETURNED (List by item No.)			NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY				DATE	

**Comments Matrix – Excavation and Materials Handling Plan (Transmittal No. 02310-6)**  
**Cornell-Dubilier Electronics Superfund Site - Operable Unit 2 – Soils Remediation**  
**Contractor – Severson Environmental Services, Inc.**  
**Reviewer – Malcolm Pirnie, Inc.**

Reviewer Comment No	Page /Para	Section	Comment	Response
1	NA	General	<p>Specification Section 02310, Paragraph 1.7, Excavation and Material Handling Plan, requires Contractor to submit a tabular site fill balance summary. Although final excavation quantities are not known at this time, please provide a copy of the proposed table template.</p> <p>This same Specification paragraph also states the following: “The Excavation Material Handling Plan shall also address the stockpiling, storage and testing of soils intended for on-site reuse or disposal. Provide a description of sampling and analysis protocols, segregation methodologies and procedures, and Soil Characterization Flow Chart”. The submitted plan does not discuss these requirements for stockpiled materials. If these discussions are included in different submittals such as the SAP, that submittal should be referenced (and verified) since it is technically required under the Excavation Materials Handling Plan as well.</p> <p>Provide a stockpile management discussion as required by the specification. How will material be stockpiled and managed in the treatment area? What stockpile processing/testing will take place for screened material greater than two inches in diameter prior to disposal?</p>	<p><u>A tabular site fill balance summary sheets will be attached at the end of this revised plan and is addressed in page 4</u></p> <p><u>Any Sampling and Analysis will be verified in the SAP Plan and is added on page 2</u></p> <p><u>Stockpile Management has been added on page 2</u></p>

**Comments Matrix – Excavation and Materials Handling Plan (Transmittal No. 02310-6)**  
**Cornell-Dubilier Electronics Superfund Site - Operable Unit 2 – Soils Remediation**  
**Contractor – Severson Environmental Services, Inc.**  
**Reviewer – Malcolm Pirnie, Inc.**

Reviewer Comment No	Page /Para	Section	Comment	Response
2	NA	General	<p>Indicate the proposed excavation sequencing for this project. Provide site plan breaking the overall proposed excavation into excavation subareas as required in Note 4 of Sheet G-06 on the Contract Drawings. Coordination with LTDD treatment/stockpile area, construction of the proposed SW detention basin (and associated conveyance piping), and general surface water control will need to be considered.</p> <p>Additionally, Specification Section 02310, Paragraph 3.2.2.1 indicates that the maximum allowable excavation open at any time shall be limited to 5 acres. This needs to be considered when creating excavation sub-areas.</p>	<p><u>The Excavation sequence has been added on page 1</u></p> <p><u>This has been added on page 1</u></p>
3	NA	General	<p>Subparagraph 6 - Specification Section 02310, Paragraph 3.5 requires the Contractor to comply with the requirements of 40 CFR 761.65 (a) (9) when temporarily storing contaminated soil and debris. There are various components of this regulation including requirements for wind design requirements, sizing/design of proposed cover material, proposed run-on control system, etc. Please supplement this Submittal to address these requirements.</p> <p>A stockpile management discussion needs to be included as indicated in Comment No 1 above.</p>	<p><u>This has been added on page 2</u></p>
4	2	II Excavation	<p>Subparagraph 5-This subparagraph should reference the Soil Erosion and Sediment Control Plan, since the technical discussion in this paragraph is brief and does not (nor should it) encompass all aspects of the plan.</p>	<p><u>This has been added on page 2</u></p>

**Comments Matrix – Excavation and Materials Handling Plan (Transmittal No. 02310-6)**  
**Cornell-Dubilier Electronics Superfund Site - Operable Unit 2 – Soils Remediation**  
**Contractor – Severson Environmental Services, Inc.**  
**Reviewer – Malcolm Pirnie, Inc.**

<b>Reviewer Comment No</b>	<b>Page /Para</b>	<b>Section</b>	<b>Comment</b>	<b>Response</b>
5	4	IV Existing Utilities	Specification Section 02310, Paragraph 1.7, Excavation and Material Handling Plan, requires the Contractor to include “procedures for working near, removing, and replacing utilities.” Provide a description of proposed utility protection measures to be implemented during excavation, backfill, and compaction activities occurring above and adjacent to the 36” water main, and other utilities, to remain in place. Specific coordination with NJ American will be required in addition to notifying NJ one call.	<u>This has been added on page 5</u>

# **Excavation and Material Handling Plan**

**Revision 1**

**Cornell - Dubilier Electronics Superfund Site  
Middlesex County, New Jersey**

Prepared For:

U.S. Army Corps of Engineers

USACE Contract Number - W912DQ-04-D-0023

Task Order - 0011

Operating Unit 2 Soils (LTDD)

Prepared By:

Sevenson Environmental Services, Inc.

2749 Lockport Road

Niagara Falls, New York 14305

February 10,, 2009

## **Excavation & Materials Handling Plan**

### **I. Introduction**

The purpose of the Excavation and Materials Handling Plan is to present the methods and procedures for excavation of contaminated soil, procedures for temporary support systems; and methods for backfilling, compacting, and grading. Severson will be responsible for obtaining any and all permits necessary for excavation, removal of Underground Storage Tanks (USTs), operation of a dewatering system, and excavation around underground utilities and as otherwise to complete the work in accordance with Federal, State and local regulatory requirements.

### **II. Excavation**

Severson will, as a minimum, excavate in the areas and depths of the excavation as indicated on the Contract Drawings or as directed by the Contracting Officer

The project site will be divided into 30-foot square grids, delineated by survey coordinates throughout the areas to be excavated. Additional grids can be added to the layout in the event the contaminated areas increase beyond the limits shown on the drawings. Each grid represents approximately 33.33 cubic yards of material in one-foot vertical increments (a 3 foot excavation would equal 100cy's, etc.). Severson will limit the open excavation areas to a maximum of five (5) acres. The site will be divided into "sub-areas" consisting of areas of five acres or less. Five acres (217,800 sf) consists of two hundred forty two (242) 30' by 30' grids (242 grids x 900 sf per grid = 217,800 sf). Area 1 consists of the four smaller excavation areas at the north area of the site. Area 2 is located at the very south area of the site encompassing grids along Spicer Avenue to the SW and Bound Brook to the east. Areas 3 and 4 will continue in a north direction from area 2. Grids will be excavated to the depth indicated on the contract drawings or as directed by the Contracting Officer. No additional or over excavation of material will be performed unless authorized by the USACE.

The excavation will be sequenced starting with the four smaller areas in sub-area 1 at the north end of the site. These areas will be excavated and backfilled prior to the mobilization of the LTTD unit. The excavated material will be stockpiled in the CDA. Once the LTTD is operational, the material from sub-area 1 will be screened and transported to the LTTD storage area, located near the unit. Excavation will then proceed to sub-area 2 located at the southern area of the site. Once sub-area 2 excavation is complete and following the guide lines of not having more than 5 open areas of excavation, excavation will proceed in a northern direction, excavating sub-area 3. This procedure will be followed for sub-area 4.

## **Excavation & Materials Handling Plan**

Excavation sequencing may require changing as site condition warrant, due to utility encounters, roadway extensions for the Borough, and LTDD requirements. In general, excavation will be performed from the south heading north on the site.

Excavated material will be required to be screened prior to being processed/treated by thermal desorption. Severson anticipates utilizing a power screen near the excavation area to screen excavated material to two inch minus prior to transporting the material to the treatment area.

Material in excess of two inches will be stockpiled for either further screening or sampled and analyzed for off-site disposal. Sampling and analysis will be performed in accordance with Severson's Sampling and Analysis Plan (SAP).

Stockpiles management will consist of preparing areas so that earthen berms encompass the stockpiles to prevent water running into the stockpiled material. Stockpiles will be covered daily, using 6 mil polyethylene, held down with sand bags. Severson will utilize the methods described in the Soil Erosion and Sediment Control Plan to manage the stockpiles. Severson will comply with 40 CFR 761.65 (a) (9) when temporarily storing contaminated material. Stockpiles will be kept to a minimum and will be made in the CDA area at locations agreed upon by the USACE and USEPA.

Severson's Soil Erosion and Sediment Control Plan will be enforced during all excavation activities.

Test pits will be excavated at predetermined locations as agreed to by the USACE to verify the waste locations shown on the drawings. Excavated material may be sampled and analyzed if the material shows signs of contamination or as directed by the USACE. Hand excavation techniques will be utilized during test pit excavation. Typically, a small utility excavator will also be utilized during test pit excavation.

Soil erosion and sediment control measures will be implemented during excavation activities. Control measures include the installation of silt fences, hay bales and geotextile, as applicable. Spraying soils with a water mist, utilizing water obtained from local fire hydrants, will control dust. A water truck will be utilized to keep dust off of haul roads and as an additional source of water for remote excavation/demolition sites.

Severson will protect existing trees, shrubs, facilities, structures, etc., by use of temporary orange safety fencing, flagging, plywood or other means, as required.

## **Excavation & Materials Handling Plan**

The USCE does not anticipate salvaging any materials recovered during excavation. If required and appropriate, decontamination of these salvageable items will be performed prior to disposal.

All items having any apparent historical or archaeological interest that is discovered in the course of any construction or excavation activities will be carefully preserved. Severson will leave the archaeological find undisturbed and will immediately report the find to the USACE so that the proper authorities may be notified. Historical or archaeological finds that might require work stoppages are not anticipated to occur during construction. Severson will decontaminate contaminated finds prior to removal from the site.

Organic materials including stumps, roots, railroad ties, and debris encountered during excavation will be considered grubbed material and will be handled, stored and disposed of as contaminated material.

Open excavations will be barricaded, fenced, or flagged to delineate this hazard.

The contaminated material will be excavated by a track backhoe. As previously mentioned, excavated material will be screened to two inch minus. A track backhoe or loader will place excavated material into the screen. Screened material will then be loaded at the excavation into trucks by a track backhoe or loader. Oversized material and debris will be stockpiled for further processing, etc. Polyethylene will be utilized to cover the sidewalls of the vehicle to be loaded to prevent contamination coming into contact with the exterior sidewalls of the vehicle. Polyethylene will also be placed on the ground where the truck is being loaded to prevent the ground surface coming into contact with contaminated material. Alternately, Severson may opt to use a decontamination station at the egress of the exclusion zone to decontaminate vehicles thus preventing contamination leaving the zone. A dump truck (truck) or heavy hauler will be placed in close proximity to the screen or debris stockpile, on the polyethylene, and the backhoe will load the contaminated material directly into the truck. The backhoe operator will use caution while loading the vehicle to prevent the vehicle becoming contaminated. Severson will not excavate or load material in severe rain. Additionally, no material will be excavated in areas where water is standing. Once the truck is loaded, the truck with the screened material will move to the treatment area. For trucks leaving the site, trucks will move to the "tarping"/ weigh station for final packaging. If there are signs of contamination on the truck, the truck will be pressured washed on the decontamination pad prior to moving to the scale for weighing. No vehicle will be shipped from the site that has free liquids in the container. Once the vehicle containing debris or other

## **Excavation & Materials Handling Plan**

oversized material is weighed and covered/tarped, it will transport the waste to the disposal facility.

Surface surveying and sampling will be performed to determine if remedial goals have been achieved. As previously mentioned, the site will be divided into 30-foot grids. This grid system will be utilized to determine location of final verification samples, and final quantities. Post excavation sampling and analysis will be performed to ensure clean up goals have been achieved. Refer to the SAP for sampling and analysis procedures. Severson will utilize a tabular site fill balance sheet to track quantities on site. A draft of this sheet is presented at the end of this plan. Additionally, Severson will utilize a grid system so that excavation and backfill areas can be tracked as the work progresses.

Severson anticipates testing stockpiled debris material at a minimum rate of one sample for every 250 tons or as required by the disposal facility. Analytical results will be submitted to and reviewed with the USACE prior to shipping the material off-site. Sampling and analysis will be performed in accordance with Severson's SAP.

At the completion of excavation and backfilling activities in the Exclusion Zone, Severson will remove any sediment tracked into the CRZ and dispose of it as contaminated material.

### **III. Surface Water Control**

Severson will install berms, swales, and other measures necessary to prevent surface water from entering and exiting excavations. Surface water will be directed away from excavation and construction sites so as to prevent erosion and to prevent surface water run on from becoming contaminated by accumulating in excavations. All diverted water will be directed to existing drain ways and storm sewer systems so as to not flood adjacent structures or properties. Asphalt berms may be utilized on asphalt surfaces to direct water flows. Backfill surfaces will be protected to prevent erosion and sloughing. Excavations will be performed so that the site and the surrounding areas at the site will be drained.

Pumping, if required, will be conducted in such a manner as to preserve the undisturbed bearing capacity of the sub-grade soils at the excavation. Well or sump installations will be constructed with sand/stone filters to prevent drawing of finer grained soil from the surrounding ground. Pumping will be performed from these sumps/wells.

## **Excavation & Materials Handling Plan**

### **IV. Existing Utilities**

Sevenson will contact the New Jersey One Call System (1-800-272-1000), Public utilities, New Jersey American Water (NJAW), and the Borough of South Plainfield, and other local utility authorities to mark out underground utilities prior to performing any excavation activities. The locations of these lines are approximate on the Contract Drawings and will be field-verified by the utility authorities. Prior to any excavation work, utility clearances will be documented with a completed Field Safety Checklist.

Sevenson will mark out on-site utilities, which are to remain in service, to prevent damaging, or disturbing utilities during construction. During excavation activities, barricades, fencing, or flagging will be utilized to delineate the areas of underground utilities so that heavy machinery does not disturb the utility. Backfilling will be performed by spreading the material over the utility with a small bulldozer, avoiding running on top of the utility. A laborer will be stationed at the excavation and backfill locations to ensure the machinery does not damage the utility. Sevenson does not anticipate removing the 36" water main as the depth of excavation does not warrant it. If protection/shoring of the water main is required, Sevenson will provide NJAW with the proposed shoring methods for NJAW's approval.

Sevenson anticipates relocating the fiber optics cable and power line for the water tower utilizing underground conduits installed at the NE area of the site, from Hamilton Road, along the RR tracks to the tower. Once this installation is complete, the power poles on site can be removed.

Utilities such as telephone poles, water pipes, gas pipes, sewer lines, property survey monuments, and USTs that are encountered during excavation may require temporary structural support. Physical removal of utilities will be coordinated with and performed by local utility authorities, as required.

### **V. Underground Storage Tanks**

If a UST is encountered during excavation, Sevenson will immediately notify the USACE.

USTs determined to be leaking or in poor condition will be removed and disposed of in accordance with an approved Underground Storage Tank Removal and Closure Plan. Heating oil, sediment, and associated piping will be removed from USTs to prevent any accidental releases. Sevenson will obtain a permit from the Local Fire Department for UST removal.

## **Excavation & Materials Handling Plan**

Contaminated underground utilities encountered during excavation will be decontaminated using a steel wire or stiff bristled brush to remove any fixed material from the utility.

### **VI. Decontamination of Subsurface Structures**

Upon the completion of excavations where utilities are exposed the utility will be decontaminated prior to backfilling. Severson will remove all attached soil material and debris from the structures using trowels, scrapers, wire brushes, vacuuming, or other methods approved by the USACE.

### **VII. Preparation of Ground Surface for Fill**

After contaminated material excavation has been completed, and prior to placement of fill material, the exposed surface of the excavations will be examined to determine the presence of ruts, disturbed ground, wet spots, soft areas, organic matter, or other features undesirable in the sub-grade. Undesirable features will be removed and corrected before placing fill material. The excavated area will undergo post excavation sampling and analysis to determine that clean up goals have been achieved.

Fill material will be moisture conditioned, as required, to obtain the specified moisture content and density for compaction.

Compaction over underground utilities will be performed by hand tamping techniques.

### **VIII. Backfilling**

Material from the treatment process will be used as backfill on site. Severson plans on installing 10 bins made from concrete blocks at the output end of the LTDD unit. Each bin will be sized to accommodate one day's production from the LTDD unit or approximately 250 CY's. Each bin's material will be sampled in accordance with the SAP to ensure the material complies with the backfill requirements prior to being utilized for backfill on site. An asphalt berm will be installed around the bin storage area, as well as the LTDD area, to prevent the run off/on of water into these locations. The requirements listed in the Soil Erosion and Sediment Control Plan will also be utilized at these areas. If additional material

## **Excavation & Materials Handling Plan**

is required, Severson will coordinate the delivery of off site backfill material to limit stockpiling the material. Backfill will not be placed within excavations without the notification or approval of the USACE.

Frozen materials will not be placed in the excavations, nor will fill be placed upon frozen material. All such materials will be removed from the excavations prior to backfilling.

Scrap metal, wood, utilities, pipes, concrete, asphalt, or any other deleterious material will not be used as backfill.

Backfilling will not commence until the excavation has been approved, underground utilities systems have been inspected, tested, and approved, forms removed, and the excavation cleaned of trash and debris.

Backfill will be placed in eight- inch (8") loose lifts. A track bulldozer or utility backhoe will spread fill material. Fill material will be compacted by vibratory drum rollers or double drum walk behind rollers. Heavy equipment will not be used within five feet (5') of an existing underground utility.

Fill material will be backfilled to the lines and grades shown on the Contract Drawings. Backfilling will not commence until excavations have met the remediation goals, all temporary supports have been removed, and approval has been received from the USACE. Backfill will not be placed on snow, ice, standing water, or frozen ground surfaces. Backfill will not be placed when the temperature is below 32 °F, unless approval is received from the USCAE.

Prior to compacting, each fill layer will be plowed, tilled, or broken up; moistened or aerated; and thoroughly mixed, to obtain the moisture content for compaction.

Backfill areas, determined to be inadequately compacted, will be recompacted and retested until the specified criteria have been met.

The following minimum values, expressed as a maximum dry density in accordance with ASTM D 1557, will be used for compaction of clean fill: 90%

All disturbed areas will be graded to provide a smooth and uniform condition/grade.

**Cornell-Dubilier Electronics**  
**Superfund Site OU-2 Soils Remedition**  
**Site Fill Balance Sheet**

Grid Designation	30'x30' Grid Centroid		Cut (-)	Fill (+)	Balance
	Northing	Easting			
AE 1	634,679	515,837			
AE 2	634,662	515,862			
AE 3	634,645	515,886			
AE 4	634,628	515,911			
AE 5	634,611	515,936			
AE 6	634,594	515,961			
AE 7	634,577	515,985			
AE 8	634,560	516,010			
AE 9	634,543	516,035			
AE 10	634,526	516,059			
AE 11	634,509	516,084			
AE 12	634,492	516,109			
AE 13	634,475	516,133			
AE 14	634,458	516,158			
AE 15	634,441	516,183			
AE 16	634,424	516,208			
AE 17	634,407	516,232			
AE 18	634,390	516,257			
AE 19	634,373	516,282			
AE 20	634,356	516,306			
AE 21	634,339	516,331			
AE 22	634,322	516,356			
AE 23	634,305	516,380			
AE 24	634,288	516,405			
AE 25	634,271	516,430			
AE 26	634,254	516,454			
AE 27	634,237	516,479			
AE 28	634,220	516,504			
AE 29	634,203	516,529			
AE 30	634,186	516,553			
AE 31	634,168	516,578			
AE 32	634,151	516,603			
AE 33	634,134	516,627			
AE 34	634,117	516,652			
AE 35	634,100	516,677			
AE 36	634,083	516,701			
AE 37	634,066	516,726			
AE 38	634,049	516,751			
AE 39	634,032	516,776			

**TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR  
MANUFACTURER'S CERTIFICATES OF COMPLIANCE**

(Read instructions on the reverse side prior to initiating this form)

**DATE**

11/04/2008

**TRANSMITTAL NO.**


02310-10

**SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS**

(This section will be initiated by the contractor)

**CONTRACT NO.**

**CHECK ONE:**

<b>TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE</b> <small>(Read instructions on the reverse side prior to initiating this form)</small>				DATE 11/04/2008		TRANSMITTAL NO. 02310-10		
<b>SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS</b> <small>(This section will be initiated by the contractor)</small>								
TO: Environmental Residency US Army Corps of Engineers 214 State Highway 18 East Brunswick, NJ 08816			FROM:		CONTRACT NO. W912DQ-04-D-0023 0011		CHECK ONE: <input checked="" type="checkbox"/> THIS IS A NEW TRANSMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL _____	
SPECIFICATION SEC. NO. (Cover only one section with each transmittal) 02310			PROJECT TITLE AND LOCATION Cornell Dubilier OU2 Soils (LTTD) 333 Hamilton Boulevard, SP, NJ 07080				CHECK ONE: THIS TRANSMITTAL IS FOR <input type="checkbox"/> FIO <input checked="" type="checkbox"/> GA <input type="checkbox"/> DA <input type="checkbox"/> CR	
ITEM NO.  a.	DESCRIPTION OF ITEM SUBMITTED (Type size, model number/etc.)  b.	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See instruction no. 8) c.	NO. OF COPIES  d.	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE  g.	VARIATION (See Instruction No. 6)  h.	FOR CE USE CODE  i.
				SPEC. PARA. NO. e.	DRAWING SHEET NO. f.			
3	Excavation Support System Plan	WORK PLAN	6	1.3		A	N	
REMARKS				I certify that the above submitted items have been reviewed in detail and are correct and in the strict conformance with the contract drawings and specifications except as otherwise stated.   _____ NAME AND SIGNATURE OF CONTRACTOR				
<b>SECTION II - APPROVAL ACTION</b>								
ENCLOSURES RETURNED (List by item No.)			NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY				DATE	

# **Excavation Support System Plan**

**Cornell - Dubilier Electronics Superfund Site  
Middlesex County, New Jersey**

Prepared For:

U.S. Army Corps of Engineers

USACE Contract Number - W912DQ-04-D-0023

Task Order - 0011

Operating Unit 2 Soils (LTTD)

Prepared By:

Sevenson Environmental Services, Inc.

2749 Lockport Road

Niagara Falls, New York 14305

November 4, 2008

## Excavation Support System Plan

### I. Introduction

The purpose of the Excavation Support System Plan is to present the methods and procedures for protection systems to be utilized during excavation at the Cornell Dubilier Superfund Site.

### II. Competent Person

Sevenson's competent person for this project will be the Superintendent, Mr. Perry Novak. As the designated competent person for the site, Mr. Novak has the training and experience necessary to recognize hazards associated with excavations, including classification of soils. Mr. Novak has the eight hour OSHA Supervisor's training and is familiar with OSHA 29 CFR 1926.650 through 652 and USACE EM 385-1-1 Section 25 – Excavation standards.

### III. Protective Systems

Excavations which are greater than four feet in depth will require the excavation to be sloped to a minimum of a 1'V: 1'H slope. Excavated material will be kept at a safe distance from the top of the excavation. In general, excavated material will be placed at a distance equal to or greater than the depth of excavation from the top of the slope.

Trench excavations, which are greater than four feet in depth, will be protected by use of a trench box, suitable for this type of excavation or by cutting the side slopes back. The manufacturer's data for the trench box will be submitted to the USACE for their information prior to use.

Excavation ingress and egress will be accomplished by use of ladders placed no more than 25 foot on center of a trench and will have a minimum of two placed for each large, open excavation.

FIELD SAMPLING PLAN – REVISION 2

CORNELL-DUBILIER ELECTRONICS SUPERFUND SITE  
OPERABLE UNIT 2 – SOIL REMEDIATION  
SOUTH PLAINFIELD, NEW JERSEY

CONTRACT # W912DQ-04-D-0023  
DELIVERY ORDER #0005

Prepared By:

SEVENSON ENVIRONMENTAL SERVICES, INC.  
2749 Lockport Road  
Niagara Falls, NY 14305

February 20, 2009

**CORNELL-DUBILIER ELECTRONICS SUPERFUND SITE  
OPERABLE UNIT 2 – SOIL REMEDIATION  
SOUTH PLAINFIELD, NEW JERSEY**

**FIELD SAMPLING PLAN – REVISION 2**

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

COC	Chain-of-Custody
CQC	Contractor Quality Control
CQCSM	Contractor Quality Control Systems Manager
DCQCR	Daily Chemical Quality Control Report
DQO	Data Quality Objective
FSP	Field Sampling Plan
Ft <sup>2</sup>	Square Feet
IDW	Investigation Derived Waste
LTTD	Low Temperature Thermal Desorption
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NJDEP	New Jersey Department of Environmental Protection
OU-2	Operable Unit 2
PCB	Polychlorinated Biphenyl
PDI	Pre-Design Investigation
PID	Photoionization Detector
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCSR	Quality Control Summary Report
ROD	Record of Decision
Sevenson	Sevenson Environmental Services, Inc.
SSHERP	Site Safety, Health, and Emergency Response Plan
SVOC	Semi-Volatile Organic Compound
TCLP	Toxicity Characteristic Leachate Procedure
USACE	United States Army Corps of Engineers
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound
Yd <sup>3</sup>	Cubic Yards

## **1.0     PROJECT DESCRIPTION**

The purpose of this Field Sampling Plan (FSP) is to provide procedures for the collection, analysis, and evaluation of data for the Cornell-Dubilier Electronics Superfund Site Operable Unit 2 (OU-2) soils in accordance with the response action selected in the United States Environmental Protection Agency (USEPA) Record of Decision (ROD). A complete discussion of the project background, site history, and contaminants of concern is included in the Introduction section of the Quality Assurance Project Plan (QAPP).

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## **2.0     PROJECT ORGANIZATION AND RESPONSIBILITIES**

The project will be staffed by Severson Environmental Services, Inc. (Severson). Project personnel were selected on the basis of appropriate skills, experience, and availability. The Severson organizational structure for this project and project personnel responsibilities are shown on Worksheet #5 of the QAPP.

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### **3.0     SCOPE AND OBJECTIVES**

#### **3.1     Task Description**

This FSP presents the technical approach for conducting data collected to support the remediation of Cornell-Dubilier OU-2 site soils. This document addresses the following sampling programs:

- Solid and liquid waste characterization sampling.
- Offsite backfill and topsoil sampling.
- Post-excavation confirmation sampling.
- Post-low temperature thermal desorption (LTTD) treatment sampling.
- Pre-excavation soil sampling proximate to Pre-Design Investigation (PDI) soil boring number SB39.
- Pre-excavation soil sampling from the northern site boundary.
- Pre- and post-remediation sampling of the LTTD treatment pad and soil stockpile/staging areas.

If any underground storage tanks (UST) are encountered during excavation activities, an Addendum to this FSP will be prepared detailing sampling and analysis requirements specific to UST removal activities which may differ from those included in this document.

#### **3.2     Applicable Regulations/Standards**

This FSP was developed to address environmental/chemical contamination necessary for the remediation of site soils. The collection of environmental/chemical contaminant data supports the Data Quality Objectives (DQOs) provided in Appendix 3, which were developed in accordance with the remedial action objectives of the ROD.

Task-specific project action limits are included in Worksheets #15-1 through #15-19 of the QAPP.

### **3.3 Project Schedule**

The implementation of this FSP will be conducted in accordance with the master project schedule as maintained by the United States Army Corps of Engineers (USACE) and Severson Project Managers. A simplified project schedule is included in Worksheet #16 of the QAPP.

#### **4.0     FIELD ACTIVITIES**

Field sampling activities in support of site remediation are presented in this section. The types of samples to be collected include: pre-excavation soil samples from select locations, solid waste disposal characterization samples, wastewater disposal characterization samples, post-excavation confirmation soil samples, post-LTTD treatment samples, and offsite source backfill and topsoil samples. Specified sample collection and identification procedures, quality assurance/quality control (QA/QC) requirements, and standard procedures necessary for obtaining data of acceptable quality are also presented in this and subsequent sections of the FSP. Qualified personnel experienced in the type of sampling being performed will conduct all sampling. Sampling personnel will adhere to health and safety requirements provided in the Site Safety, Health, and Emergency Response Plan (SSHERP). The following sections detail the methods of collection for each of the sampling matrixes listed above.

##### **4.1     Pre-Excavation Soil Sampling – PDI Boring SB39**

Prior to intrusive remediation activities, four samples will be collected proximate to PDI soil boring number SB39. The samples will be analyzed for dioxins/furans as summarized in Table 4-1. The samples will be collected from each corner of a 10-foot by 10-foot square established around the SB39 boring, with the existing boring point at its center (located at coordinates N 634461.1300, E 516911.9300). Samples will be collected to a depth of 4-feet below ground surface. It is anticipated that soil samples will be collected from each location using an auger or other soil coring device following the procedures included in the New Jersey Department of Environmental Protection (NJDEP) *Field Sampling Procedures Manual* (NJDEP, 2005). The samples will be collected as follows:

- Gloves will be donned immediately prior to sampling and a clean pair of new disposable gloves will be worn each time a different location is sampled.
- Remove unnecessary rocks, twigs, and other non-soil materials from selected sampling point.
- Begin turning the auger with a clockwise motion and continue until the desired sampling depth is obtained.
- Use a second auger to collect the sample. Discard one-half inch of material in the top portion of the auger due to cave-in.
- Place the sample into a clean decontaminated stainless steel bowl to be homogenized. The bowl must be large enough to hold more than the required sample volume and to allow proper mixing without

spillage. Homogenization will be conducted using a decontaminated stainless steel spoon or spatula. The soil should be scraped from the sides, corners, and bottom, rolled into the middle of the bowl, and mixed. The soil should then be quartered (i.e., divided into four sections) and moved to the sides of the bowl. Each quarter should then be mixed individually, and then rolled to the center of the bowl and mixed with the entire sample again. These steps of quartering the soil, mixing individually, and then mixing the entire sample again should be repeated at least twice. The goal of the homogenization is to achieve a consistent physical appearance over the entire soil sample.

- Transfer the sample into laboratory cleaned sample jars using a clean decontaminated stainless steel spoon or spatula.

#### **4.2 Pre-Excavation Soil Sampling – Northern Site Boundary**

In order to delineate the contamination along the northern site boundary adjacent to the Conrail railroad tracks, pre-excavation soil samples will be collected from the Conrail property. Prior to collecting these samples, the USEPA will obtain an access agreement with Conrail. The samples will be analyzed for metals, cyanide, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and dioxins/furans as summarized in Table 4-1. The locations of the samples are expected to be within rows “bb” and “ba” of the sample grid layout included in Appendix 1. One sample will be collected from the center of each pre-established 30 by 30 foot grid at the surface (i.e., 0-6 inches) and at depth (i.e., 18-24 inches), such that the initial samples will be collected at a distance of 15-feet from the fence line. Following review of the sample results, additional samples may be collected closer to the fence line (i.e., 7.5 feet from the fence line) or at a greater depth at the direction of USACE and USEPA. It is anticipated that soil samples will be collected from each selected location using an auger or other soil coring device following the procedures included in the NJDEP *Field Sampling Procedures Manual* (NJDEP, 2005). The samples will be collected as follows:

- Gloves will be donned immediately prior to sampling and a clean pair of new disposable gloves will be worn each time a different location is sampled.
- Remove unnecessary rocks, twigs, and other non-soil materials from selected sampling point.
- Begin turning the auger with a clockwise motion and continue until the desired sampling depth is obtained.
- Use a second auger to collect the sample. Discard one-half inch of material in the top portion of the auger due to cave-in.

- Place the sample for VOC analysis directly into the EnCore™ sampler by inserting the coring tool into the soil, taking care not to trap air behind the sample. Wipe the exterior of the barrel to ensure a tight seal. Snap the cap in the open end.
- Place the sample into a clean decontaminated stainless steel bowl to be homogenized. The bowl must be large enough to hold more than the required sample volume and to allow proper mixing without spillage. Homogenization will be conducted using a decontaminated stainless steel spoon or spatula. The soil should be scraped from the sides, corners, and bottom, rolled into the middle of the bowl, and mixed. The soil should then be quartered (i.e., divided into four sections) and moved to the sides of the bowl. Each quarter should then be mixed individually, and then rolled to the center of the bowl and mixed with the entire sample again. These steps of quartering the soil, mixing individually, and then mixing the entire sample again should be repeated at least twice. The goal of the homogenization is to achieve a consistent physical appearance over the entire soil sample.
- Transfer the sample into laboratory cleaned sample jars using a clean decontaminated stainless steel spoon or spatula.

#### **4.3 LTTD Treatment Pad and Soil Stockpile/Staging Area Sampling**

Pre- and post-remedial action testing will be performed at the location of the LTTD treatment pad and surrounding the soil stockpile/staging locations in order to assess if cross-contamination occurred during remedial activities. The samples will be analyzed for metals, cyanide, VOCs, SVOCs, pesticides, PCBs, and dioxins/furans as summarized in Table 4-1. Five samples will be collected at regular spacing, from a depth interval of zero to six inches below grade as approved by the USACE Contracting Officer. It is anticipated that soil samples will be collected from each selected location using a clean decontaminated stainless steel trowel following the procedures included in the NJDEP *Field Sampling Procedures Manual* (NJDEP, 2005). The samples will be collected as follows:

- Gloves will be donned immediately prior to sampling and a clean pair of new disposable gloves will be worn each time a different location is sampled.
- At specified intervals, take small, equal portions of sample from the surface and immediately below the surface with a clean decontaminated stainless steel trowel.
- Place the sample for VOC analysis directly into the EnCore™ sampler by inserting the coring tool into the soil, taking care not to trap air behind the sample. Wipe the exterior of the barrel to ensure a tight seal. Snap the cap in the open end.

- Place the sample into a clean decontaminated stainless steel bowl to be homogenized. The bowl must be large enough to hold more than the required sample volume and to allow proper mixing without spillage. Homogenization will be conducted using a decontaminated stainless steel spoon or spatula. The soil should be scraped from the sides, corners, and bottom, rolled into the middle of the bowl, and mixed. The soil should then be quartered (i.e., divided into four sections) and moved to the sides of the bowl. Each quarter should then be mixed individually, and then rolled to the center of the bowl and mixed with the entire sample again. These steps of quartering the soil, mixing individually, and then mixing the entire sample again should be repeated at least twice. The goal of the homogenization is to achieve a consistent physical appearance over the entire soil sample.
- Transfer the sample into laboratory cleaned sample jars using a clean decontaminated stainless steel spoon or spatula.

#### **4.4 Solid Waste Characterization Sampling**

Waste characterization samples will be collected from excavated soil and debris which are determined to not be suitable for treatment in the onsite LTDD unit for waste characterization and disposal facility approval. The waste characterization samples will be analyzed for corrosivity, ignitability, hydrogen cyanide reactivity, hydrogen sulfide reactivity, toxicity characteristic leachate procedure (TCLP) VOCs, TCLP SVOCs, TCLP pesticides, TCLP herbicides, TCLP metals, and total PCBs as summarized in Table 4-1. If the waste material is generated from an area suspected to contain dioxins/furans (i.e., area north of the capacitor disposal area), samples will also be collected for dioxin/furan analysis. The sample results and the completed waste profile will be sent to the offsite disposal facility for waste shipment approval.

Grab samples will be collected for the VOCs and composite samples will be collected for other analytes. The compositing procedure is designed to provide a representative sample of the waste material by combining three discrete samples from within the debris stockpile or disposal bin (e.g., roll-off container). These discrete samples will be spread evenly so that they are spatially representative of the waste materials both horizontally and vertically (i.e., one each at shallow, medium, and deep depths along the length of the container or stockpile). The VOC sample will be collected from one of the three discrete locations selected utilizing a photoionization detector (PID); the sample will be collected from the location with the highest PID reading.

Prior to sampling, a visual inspection of the waste materials will be performed to located areas suitable for sampling. If necessary based on the size of the materials, a hand-held hammer or similar chipping device will be utilized to break down the materials prior to sample collection. Once the sampling locations have been determined, the following procedure will be followed for each sampling depth:

- Gloves will be donned immediately prior to sampling and a clean pair of new disposable gloves will be worn each time a different location is sampled.
- Using a clean decontaminated hand auger or sampling trowel, collect sufficient sample from three discrete sample locations into a clean decontaminated container.
- For the sampling location selected for VOC analysis, the last part of the sample collected should be placed directly into the appropriate laboratory cleaned sample jars. The jar should contain as little headspace as possible.
- Place the sample into a clean decontaminated stainless steel bowl to be homogenized. The bowl must be large enough to hold more than the required sample volume and to allow proper mixing without spillage. Homogenization will be conducted using a decontaminated stainless steel spoon or spatula. The soil should be scraped from the sides, corners, and bottom, rolled into the middle of the bowl, and mixed. The soil should then be quartered (i.e., divided into four sections) and moved to the sides of the bowl. Each quarter should then be mixed individually, and then rolled to the center of the bowl and mixed with the entire sample again. These steps of quartering the soil, mixing individually, and then mixing the entire sample again should be repeated at least twice. The goal of the homogenization is to achieve a consistent physical appearance over the entire soil sample.
- Transfer the sample into laboratory cleaned sample jars using a clean decontaminated stainless steel spoon or spatula.
- Leftover sample material will be placed back into the stockpile or disposal bin.

#### **4.5 Wastewater Characterization Sampling**

Wastewaters generated during Site activities will include decontamination water and storm water which may accumulate in the remediation areas. Liquid wastes will be containerized in an aboveground storage tank. Aqueous samples will be collected to determine the waste management approach. The goal of sampling the wastewaters will be to meet Federal, state, and local regulations in accordance with the requirements of the disposal facility. The waste characterization samples will be analyzed for corrosivity, ignitability, hydrogen cyanide reactivity, hydrogen sulfide reactivity, TCLP VOCs, TCLP SVOCs, TCLP pesticides, TCLP

herbicides, TCLP metals, and total PCBs as summarized in Table 4-1. If the waste material is generated from an area suspected to contain dioxins/furans (i.e., area north of the capacitor disposal area), samples will also be collected for dioxin/furan analysis. The sample results and the completed waste profile will be sent to the offsite disposal facility for waste shipment approval.

Samples will be collected using dedicated, disposable polyvinyl chloride or Teflon bailers. The following sample procedure is consistent with NJDEP sampling instructions (NJDEP, 2005):

- Prepare the work area by placing plastic sheeting on the ground to avoid cross-contamination.
- Attach a bailer to cable or line for lowering. Polyethylene or nylon rope is recommended.
- Lower the bailer slowly until it contacts the water surface.
- Allow the bailer to sink and fill.
- Slowly raise the bailer to the surface. Do not allow the bailer line or bailer to contact the ground surface.
- Fill sample bottles by tipping bailer to allow slow discharge from the top to flow gently down the side of the sample bottle with minimum turbulence. If a bottom drain is present on the bailer, achieve a slow steady flow.
- Repeat as necessary to acquire sufficient volume to fill all sample containers.

#### **4.6 Post-Excavation Soil Sampling**

Soil samples will be collected at the site in order to provide the data necessary to establish that soil with concentrations greater than the project action levels have been removed from the excavation prior to site restoration. Samples will be collected from the floor and sidewalls of the excavation. Samples will be analyzed for metals and cyanide, VOCs, SVOCs, pesticides, PCBs, and dioxins/furans as summarized in Table 4-1.

Grid floor verification soil samples will be collected at the bottom center of each 30-foot grid (i.e., one sample every 900 square feet (ft<sup>2</sup>)). Sidewall verification samples will be collected from the horizontal and vertical midpoint of the sidewall every 30-feet of the excavation. A PID will be utilized to determine where the sample for VOC analysis should be collected; the sample will be collected at the bottom of each 30-foot grid with the highest PID reading and along each 30-feet of sidewall with the highest PID reading. A map showing the approximate limits of excavation and sample grids, and a spreadsheet listing the coordinates of

the center of each of the sample grids are included in Appendix 1. If a grid verification sample exceeds the cleanup criteria, additional soil will be removed and the grid bottom and sidewalls will be tested again. This process will be repeated until grid verification sample results are less than the cleanup criteria are detected.

It is anticipated that soil samples will be collected from each selected location using a clean decontaminated stainless steel trowel following the procedures included in the NJDEP *Field Sampling Procedures Manual* (NJDEP, 2005). The samples will be collected as follows:

- Gloves will be donned immediately prior to sampling and a clean pair of new disposable gloves will be worn each time a different location is sampled.
- At specified intervals, take small, equal portions of sample from the surface and immediately below the surface with a clean decontaminated stainless steel trowel.
- Place the sample for VOC analysis directly into the 5-gram EnCore™ sampler by inserting the coring tool into the soil, taking care not to trap air behind the sample. Wipe the exterior of the barrel to ensure a tight seal. Snap the cap in the open end.
- Place the sample into a clean decontaminated stainless steel bowl to be homogenized. The bowl must be large enough to hold more than the required sample volume and to allow proper mixing without spillage. Homogenization will be conducted using a decontaminated stainless steel spoon or spatula. The soil should be scraped from the sides, corners, and bottom, rolled into the middle of the bowl, and mixed. The soil should then be quartered (i.e., divided into four sections) and moved to the sides of the bowl. Each quarter should then be mixed individually, and then rolled to the center of the bowl and mixed with the entire sample again. These steps of quartering the soil, mixing individually, and then mixing the entire sample again should be repeated at least twice. The goal of the homogenization is to achieve a consistent physical appearance over the entire soil sample.
- Transfer the sample into laboratory cleaned sample jars using a clean decontaminated stainless steel spoon or spatula.
- Any leftover material will be placed back into the excavation area.

#### **4.7 Post-LTTD Treatment Sampling**

The output of the onsite LTTD unit will be used as onsite backfill following treatment. Prior to reuse, samples of the output will be analyzed to confirm that they are free from chemical contamination. Samples meeting the project action levels will be used as onsite backfill without further treatment. Sample results

exceeding the criteria will be considered unacceptable as backfill without additional treatment. If the sample results exceed the criteria, consideration may also be given to offsite disposal of the affected material. Samples will be collected from each day's treated volume and analyzed for metals and cyanide, VOCs, SVOCs, pesticides, PCBs, and dioxins/furans as summarized in Table 4-1.

Grab samples will be collected for the VOCs and composite samples will be collected for other analytes. The compositing procedure is designed to provide a representative sample of the treated material by combining three discrete samples from within the treated material stockpile or bin. These discrete samples will be spread evenly so that they are spatially representative of the material both horizontally and vertically (i.e., one each at shallow, medium, and deep depths along the length of the container or stockpile). The VOC sample will be collected from one of the three discrete locations selected utilizing a PID; the sample will be collected from the location with the highest PID reading.

Prior to sampling, a visual inspection of the material will be performed to located areas suitable for sampling. Once the sampling locations have been determined, the following procedure will be followed for each sampling depth:

- Gloves will be donned immediately prior to sampling and a clean pair of new disposable gloves will be worn each time a different location is sampled.
- Using a clean decontaminated hand auger or sampling trowel, collect sufficient sample from three discrete sample locations into a clean decontaminated container.
- Place the sample for VOC analysis directly into the 5-gram EnCore™ sampler by inserting the coring tool into the soil, taking care not to trap air behind the sample. Wipe the exterior of the barrel to ensure a tight seal. Snap the cap in the open end.
- Place the sample into a clean decontaminated stainless steel bowl to be homogenized. The bowl must be large enough to hold more than the required sample volume and to allow proper mixing without spillage. Homogenization will be conducted using a decontaminated stainless steel spoon or spatula. The soil should be scraped from the sides, corners, and bottom, rolled into the middle of the bowl, and mixed. The soil should then be quartered (i.e., divided into four sections) and moved to the sides of the bowl. Each quarter should then be mixed individually, and then rolled to the center of the bowl and mixed with the entire sample again. These steps of quartering the soil, mixing individually, and then mixing the entire sample again should be repeated at least twice. The goal of the homogenization is to achieve a consistent physical appearance over the entire soil sample.

- Transfer the sample into laboratory cleaned sample jars using a clean decontaminated stainless steel spoon or spatula.
- Leftover sample material will be placed back into the stockpile or bin.

#### **4.8 Offsite Topsoil/Backfill Sampling**

It is anticipated that the majority of the backfill needed for site restoration will be obtained from the treated output of the onsite LTTD unit. As necessary, backfill material consisting of common and structural fill, standard topsoil, and crushed stone will be obtained from offsite sources. Backfill and topsoil from offsite sources will be tested for physical suitability and chemical parameters prior to use. Samples of topsoil and backfill materials from each offsite source will be collected and analyzed to determine that these materials do not present a threat to human health and/or the environment. Samples will be analyzed for metals and cyanide, VOCs, SVOCs, pesticides, PCBs, pH, and radiological parameters as summarized in Table 4-1.

A minimum of one set of laboratory analysis will be performed per 5,000 cubic yards (yd<sup>3</sup>) of material used. No less than one set of analyses will be performed per borrow area. As quantities of backfill/topsoil are brought onsite in excess of 5,000yd<sup>3</sup>, one sample per additional 5,000yd<sup>3</sup> of material will be analyzed. Documentation certifying that all criteria have been met for offsite backfill/topsoil will be forwarded to the USACE prior to bringing any material onsite.

Grab samples will be collected for the VOCs and composite samples will be collected for other analytes. The compositing procedure is designed to provide a representative sample of the material by combining three discrete samples. These discrete samples will be spread evenly so that they are spatially representative of the material both horizontally and vertically (i.e., one each at shallow, medium, and deep depths along the length of the borrow source). The VOC sample will be collected from one of the three discrete locations selected utilizing a PID; the sample will be collected from the location with the highest PID reading.

Prior to sampling, a visual inspection of the material will be performed to located areas suitable for sampling. Once the sampling locations have been determined, the following procedure will be followed for each sampling depth:

- Gloves will be donned immediately prior to sampling and a clean pair of new disposable gloves will be worn each time a different location is sampled.

- Using a clean decontaminated hand auger or sampling trowel, collect sufficient sample from three discrete sample locations into a clean decontaminated container.
- Place the sample for VOC analysis directly into the 5-gram EnCore™ sampler by inserting the coring tool into the soil, taking care not to trap air behind the sample. Wipe the exterior of the barrel to ensure a tight seal. Snap the cap in the open end.
- Place the sample into a clean decontaminated stainless steel bowl to be homogenized. The bowl must be large enough to hold more than the required sample volume and to allow proper mixing without spillage. Homogenization will be conducted using a decontaminated stainless steel spoon or spatula. The soil should be scraped from the sides, corners, and bottom, rolled into the middle of the bowl, and mixed. The soil should then be quartered (i.e., divided into four sections) and moved to the sides of the bowl. Each quarter should then be mixed individually, and then rolled to the center of the bowl and mixed with the entire sample again. These steps of quartering the soil, mixing individually, and then mixing the entire sample again should be repeated at least twice. The goal of the homogenization is to achieve a consistent physical appearance over the entire soil sample.
- Transfer the sample into laboratory cleaned sample jars using a clean decontaminated stainless steel spoon or spatula.
- Leftover sample material will be placed back into the borrow source.

#### **4.9 Investigative-Derived Wastes**

Efforts will be made throughout the field program to minimize the volume of waste derived from sampling and decontamination procedures. Investigation-derived wastes (IDW) will be shipped to a commercial disposal facility, as necessary. IDW will be managed, stored, and disposed in accordance with USEPA and United States Department of Transportation (USDOT) regulation and requirements of the receiving facility.

##### **4.9.1 Disposable Equipment and Debris**

Disposable equipment and debris, such as health and safety equipment, plastic sheeting, sampling equipment, and other equipment or debris not reused during project operations will be collected in plastic bags during sampling and placed into appropriately labeled containers. The containers will be stored in a suitable location as determined by Site personnel. As possible, the debris will be consolidated with bulk solids for offsite disposal under an approved waste disposal profile that includes a percentage of site debris in the waste stream.

#### **4.9.2 Wastewater**

Field sampling equipment will be decontaminated following procedures specified in Section 4.11 of this FSP. Decontamination fluids and other aqueous wastes generated from sampling will be collected in the field in five gallon buckets, or other appropriate container, and returned to a designated storage area for transfer to the bulk storage tank, as appropriate. The wastewater will be sampled as described in Section 4.5 and tested as required for disposal at a permitted wastewater treatment facility.

#### **4.9.3 General Office Trash/Debris**

Any Site debris that is not generated during the collection of environmental samples will be considered municipal trash. This may include any paper or non-paper office wastes, non-contact sampling wastes (e.g., plastic wrapping, cardboard boxes), or other daily trash. All municipal trash will be deposited in a collection container provided by and serviced for periodic removal by a commercial trash hauling and disposal company. No additional management, tracking, or testing of this waste will be conducted.

#### **4.10 QA/QC Samples**

QA/QC samples will be collected and analyzed as a check of field measurements and in order to verify the contract laboratory's performance on chemical samples. QA/QC samples will be collected at a frequency of ten percent of field samples collected for offsite analysis per method per matrix, with the exception of waste characterization samples, and will include blind field replicates and matrix and matrix spike duplicates sent to the primary laboratory. All QA/QC samples shall be identified in the Field Logbook. Confirmation of the collection of the QA/QC samples at the required frequency will be initiated by the samplers in the field, and verified by the Contractor Quality Control Systems Manager (CQCSM) during field audits and the project chemist during analytical data review. A log of all samples obtained, including QA/QC samples, will be maintained at the Site. Project QA/QC samples are also discussed in QAPP Worksheets #20 and #28.

##### **4.10.1 Replicate Samples**

A field QC duplicate sample is a second sample collected at the same location as the original sample used as an indicator of overall measurement (sampling and analytical) precision. Duplicate samples are collected using identical sampling techniques, and treated in an identical manner during storage, transportation, and

analysis. QC samples will be collected as one sample, homogenized and split into two samples, separately containerized and shipped as two independent samples. Field QC samples will be collected at a rate of ten percent of the total number of field samples that are collected for laboratory analysis per matrix. Field QC samples will be shipped to the primary analytical laboratory blindly, with notations made in the daily sample log as to which environmental sample the QC sample is associated. Replicate samples will be collected, containerized, preserved, and shipped in the same manner as environmental samples per Table 4-1.

#### **4.10.2 Matrix Spike/Matrix Spike Duplicates**

Matrix spike (MS) and matrix spike duplicate (MSD) samples are environmental samples to which known concentrations of target analytes have been added by the laboratory. MS and MSD samples are analyzed to evaluate the effect of the sample matrix on the analytical methodology. MS and MSD samples are generated by taking a separate aliquot of an actual field sample and spiking it with the selected target analyte(s) prior to sample preparation or extraction. The MS and MSD samples then undergo the same extraction and analytical procedures as the unfortified field sample. Per the February 19, 2009 scoping session (see QAPP Worksheet #9), a request will be made to have the laboratory perform MS and MSD analysis with site samples. Additional sample volume will be collected and submitted to the laboratory from the site for the purpose of MS and MSD analysis with each shipment of samples.

#### **4.11 Sampling Equipment Decontamination**

The following describes standard operating procedures for the decontamination of non-disposable sampling equipment and tools that may come into direct contact with a field sample intended for analytical analysis. This procedure only addresses the decontamination of equipment as it pertains to the chemical integrity of samples for analysis and is not intended for use in health and safety decontamination of personnel, materials, and equipment that may become contaminated during field operations.

##### **4.11.1 Applicability**

Decontamination of all analytical devices, sampling tools, and storage equipment that may come into direct contact with a field sample is necessary in order to achieve analytical results that are representative of true field conditions. To the extent practical, no sampling equipment will be decontaminated in the field and disposable sampling equipment will be utilized. Sufficient sampling equipment will be pre-cleaned, wrapped

in aluminum foil, and brought to the field. Sample containers will be pre-cleaned in accordance with USEPA protocols and will be supplied by the laboratory.

The decontamination procedures below may be modified, upon proper managerial approval, as long as the chemical integrity of the field sample is maintained and the sample source is not permanently compromised. Anticipated contaminants and concentrations, matrices (water, air, soil, etc.), surface area of possible cross contamination, method of sampling, and many other factors are considered when establishing a sampling equipment decontamination procedure. Any modifications of the procedures below will be carefully thought out, approved by Severson's CQCSM and the USACE Contracting Officer or a Designated Representative, and documented accordingly. Samples will be collected from locations with the lowest known concentrations of contaminants first, progressing toward the areas of highest known contaminations. This procedure will minimize the potential for cross contamination of samples.

#### **4.11.2 Procedures**

All equipment will be considered contaminated unless determined otherwise. In order to provide consistency to the decontamination procedure, a designated sampling team crewmember will be responsible for equipment decontamination. Similarly, it is desirable to decontaminate all the equipment necessary for a field task prior to mobilization. In this way, field decontamination will be limited. As an aid to field personnel and as part of the Site QC inspections, Severson Checklist Number 009, "Task Specific QC Checklist – Decontamination", is included in Appendix 5.

##### **4.11.2.1 Decontamination Equipment List**

The following supplies are needed for equipment decontamination:

- Clean disposable nitrile gloves
- Wastewater container (drum, basin, or buckets)
- Clean water spraying devices (plastic squirt or spray bottles)
- Clean brushes
- Plastic garbage bags
- Non-phosphate detergent (e.g., Alconox<sup>®</sup>)

- Deionized/distilled water
- Clean plastic buckets and other containers, as needed (e.g., small plastic swimming pool)
- Plastic sheeting to cover ground at work station
- Aluminum foil
- Package labels, ink pens, and black markers
- Potable water, warm if available

#### **4.11.2.2 General Equipment Decontamination Procedure**

The following steps will be considered as Severson's general equipment decontamination procedure:

- Cover hands with disposable gloves.
- Wash and scrub, as necessary, with a solution of non-phosphate detergent (e.g., Alconox) and potable water.
- Rinse thoroughly with potable water.
- Rinse with deionized/distilled water.
- Air dry.

All waste liquids generated by the decontamination procedure will be containerized and tested for waste characterization. Any solid wastes generated, such as personal protective equipment, will be containerized, tested for waste characterization, and transported for disposal.

Decontaminated equipment not intended for immediate use will be wrapped in aluminum foil, placed in plastic bags, and sealed. All handling of decontaminated equipment will be performed using clean disposable gloves. Care will be exercised in the storage of decontaminated equipment, so as to not re-contaminate what has been cleaned. Sampling personnel will also avoid solvents, greases, oils, gasoline, water, dusts, and other potential sources that might contaminate the equipment before its use. Sampling personnel handling such materials shall wear protective gloves when doing so.

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**Table 4-1: Sampling and Analysis Matrix**

<i>Sample</i>	<i>Location</i>	<i>Rationale</i>	<i>Estimated Number of Samples</i>	<i>Frequency</i>	<i>Parameter(s)</i>	<i>Sample Type</i>	<i>Type of Bottles<sup>1,2</sup></i>	<i>Number of Bottles<sup>1,2</sup></i>	<i>Methodology</i>	<i>Holding Time<sup>3</sup></i>	<i>Preservative</i>
Pre-Excavation Soil Samples	Proximate to PDI soil boring SB39	Further characterize the soil proximate to PDI soil boring number SB39	4	Once	Dioxins/Furans	Grab	4oz. AG	1	SW-846 8290 or USEPA CLP DLM02.0	<u>SW-846 8290</u> ; 30 days to extraction; 45 days to analysis <u>DLM02.0</u> ; 10 days to extraction; 30 days to analysis	Cool 4°C
Pre-Excavation Soil Samples	Northern site boundary	Delineate site-related contaminants that are identified along the Conrail property located along the northern site boundary	To Be Determined in the field by the USACE Contracting Officer	Once	VOCs	Grab	EnCore™ sampler	2	SW-846 5035/8260B or USEPA CLP SOM01.2	48 hours to preservation by laboratory; <u>SW-846 8260B</u> ; 14 days to analysis <u>SOM01.2</u> ; 10 days to analysis	Cool 4°C
					TCL SVOCs	Grab	32oz. CWM	2	SW-846 3550C/8270C or USEPA CLP SOM01.2	<u>SW-846 8270C</u> ; <u>8081A</u> ; <u>8082</u> ; 14 days to extraction; 40 days to analysis	Cool 4°C
					TCL Pesticides	Grab			SW-846 3550C/8081A or USEPA CLP SOM01.2		Cool 4°C
					Total PCBs	Grab			SW-846 3550C/8082 or USEPA CLP SOM01.2	<u>SOM01.2</u> ; 10 days to extraction; 40 days to analysis	Cool 4°C
					Cyanide	Grab			SW-846 Method 9014 or USEPA CLP ILM05.4	<u>SW-846 9014</u> ; 14 days <u>ILM05.4</u> ; 12 days	Cool 4°C

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**Table 4-1: Sampling and Analysis Matrix**

<i>Sample</i>	<i>Location</i>	<i>Rationale</i>	<i>Estimated Number of Samples</i>	<i>Frequency</i>	<i>Parameter(s)</i>	<i>Sample Type</i>	<i>Type of Bottles<sup>1,2</sup></i>	<i>Number of Bottles<sup>1,2</sup></i>	<i>Methodology</i>	<i>Holding Time<sup>3</sup></i>	<i>Preservative</i>
					TAL Metals	Grab			SW-846 3050/6010B/7471A or USEPA CLP ILM05.4	SW-846 6010B; 180 days to digestion; 180 days to analysis SW-846 7471A; 28 days to digestion; 28 days to analysis ILM05.4; 180 days for all metals except mercury; 26 days for mercury	Cool 4°C
					Dioxins/Furans	Grab	4oz. AG	1	SW846-8290 or USEPA CLP DLM02.0	SW-846 8290; 30 days to extraction; 45 days to analysis DLM02.0; 10 days to extraction; 30 days to analysis	Cool 4°C
LTDD Treatment Pad and Soil Stockpile/Staging Area Samples	LTDD treatment pad and soil stockpile/staging area pre- and post-remediation	Assess is cross-contamination occurred beneath the LTDD treatment pad and stockpile/staging areas during remedial activities	10	5 samples pre-remediation and 5 samples post-remediation	VOCs	Grab	EnCore™ sampler	2	SW-846 5035/8260B or USEPA CLP SOM01.2	48 hours to preservation by laboratory; SW-846 8260B; 14 days to analysis SOM01.2; 10 days to analysis	Cool 4°C
					TCL SVOCs	Grab	32oz. CWM	2	SW-846 3550C/8270C or USEPA CLP SOM01.2	SW-846 8270C; 8081A; 8082; 14 days to extraction; 40 days to analysis	Cool 4°C
					TCL Pesticides	Grab			SW-846 3550C/8081A or USEPA CLP SOM01.2		Cool 4°C

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**Table 4-1: Sampling and Analysis Matrix**

<i>Sample</i>	<i>Location</i>	<i>Rationale</i>	<i>Estimated Number of Samples</i>	<i>Frequency</i>	<i>Parameter(s)</i>	<i>Sample Type</i>	<i>Type of Bottles<sup>1,2</sup></i>	<i>Number of Bottles<sup>1,2</sup></i>	<i>Methodology</i>	<i>Holding Time<sup>3</sup></i>	<i>Preservative</i>
					Total PCBs	Grab			SW-846 3550C/8082 or USEPA CLP SOM01.2	<u>SOM01.2</u> : 10 days to extraction; 40 days to analysis	Cool 4°C
					Cyanide	Grab			SW-846 Method 9014 or USEPA CLP ILM05.4	<u>SW-846 9014</u> : 14 days <u>ILM05.4</u> : 12 days	Cool 4°C
					TAL Metals	Grab			SW-846 3050/6010B/7471A or USEPA CLP ILM05.4	<u>SW-846 6010B</u> : 180 days to digestion; 180 days to analysis <u>SW-846 7471A</u> : 28 days to digestion; 28 days to analysis <u>ILM05.4</u> : 180 days for all metals except mercury; 26 days for mercury	Cool 4°C
					Dioxins/Furans	Grab	4oz. AG	1	SW846-8290 or USEPA CLP DLM02.0	<u>SW-846 8290</u> : 30 days to extraction; 45 days to analysis <u>DLM02.0</u> : 10 days to extraction; 30 days to analysis	Cool 4°C
Solid Waste Characterization	Stockpiles and disposal bins	Meet federal, state, and local regulations in accordance with the requirements of the disposal facility	Approximately 125	1 sample per 250yd <sup>3</sup>	Ignitability	Composite	32oz. CWM	1	SW-846 1010	7 days	Cool 4°C
					Corrosivity				SW-846 9045C	14 days	
					Reactive Cyanide				SW-846 Section 7.4.3.2/ Method 9014	14 days	
					Reactive Sulfide				SW-846 Section 7.4.4.2/ Method 9034	7 days	

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**Table 4-1: Sampling and Analysis Matrix**

<i>Sample</i>	<i>Location</i>	<i>Rationale</i>	<i>Estimated Number of Samples</i>	<i>Frequency</i>	<i>Parameter(s)</i>	<i>Sample Type</i>	<i>Type of Bottles<sup>1,2</sup></i>	<i>Number of Bottles<sup>1,2</sup></i>	<i>Methodology</i>	<i>Holding Time<sup>3</sup></i>	<i>Preservative</i>
					TCLP Metals				SW-846 1311/3015/6010B/ 7470A or USEPA CLP ILM05.4	SW-846 <u>6010B</u> ; 180 days to TCLP extraction; 180 days to analysis SW-846 <u>7471A</u> ; 28 days to TCLP extraction; 28 days to analysis ILM05.4; 180 days to TCLP extraction for all metals except mercury; 26 days to TCLP extraction for mercury	
					TCLP SVOCs				SW-846 1311/3510C/8270C or USEPA CLP SOM01.2	SW-846 <u>8270C</u> ; <u>8081A</u> ; 14 days to TCLP extraction; 7 days to preparative extraction; 40 days to analysis SOM01.2; 12 days to TCLP extraction; 5 days to preparative extraction; 40 days to analysis	
					TCLP Pesticides				SW-846 1311/3510C/8081A or USEPA CLP SOM01.2		

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**Table 4-1: Sampling and Analysis Matrix**

<i>Sample</i>	<i>Location</i>	<i>Rationale</i>	<i>Estimated Number of Samples</i>	<i>Frequency</i>	<i>Parameter(s)</i>	<i>Sample Type</i>	<i>Type of Bottles<sup>1,2</sup></i>	<i>Number of Bottles<sup>1,2</sup></i>	<i>Methodology</i>	<i>Holding Time<sup>3</sup></i>	<i>Preservative</i>
					TCLP Herbicides				SW-846 1311/3510C/8151A or USEPA CLP SOM01.2	14 days to TCLP extraction 7 days to preparative extraction 40 days to analysis	
					Total PCBs	Composite	4 oz. CWM	1	SW-846 3550C/8082 or USEPA CLP SOM01.2	<u>SW-846 8082</u> ; 14 days to extraction; 40 days to analysis <u>SOM01.2</u> ; 10 days to extraction; 40 days to analysis	Cool 4°C
					TCLP VOCs	Grab	4 oz. CWM	2	SW-846 1311/5030B/8260B or USEPA CLP SOM01.2	<u>SW-846 8260B</u> ; 14 days to TCLP extraction; 14 days to analysis <u>SOM01.2</u> ; 10 days to TCLP extraction; 10 days to analysis	Cool 4°C
					Dioxins/Furans (from suspect waste materials, i.e., area north of the capacitor disposal area)	Grab	4oz. AG	1	SW846-8290 or USEPA CLP DLM02.0	<u>SW-846 8290</u> ; 30 days to extraction; 45 days to analysis <u>DLM02.0</u> ; 10 days to extraction; 30 days to analysis	Cool 4°C
Wastewater <sup>4</sup>	Storage tank	Meet federal, state, and local regulations in accordance with the requirements	10	One sample per full storage tank	Ignitability	Composite	1L AG	3	SW-846 1010	7 days	Cool 4°C
					Corrosivity				SW-846 9040C	Immediately	
					Reactive Cyanide				SW-846 Section 7.4.3.2/ Method 9014	14 days	

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		of the disposal facility			Reactive Sulfide				SW-846 Section 7.4.4.2/ Method 9034	7 days	
					TCLP Metals				SW-846 1311/3015/6010B/ 7470A or USEPA CLP ILM05.4	SW-846 6010B; 180 days to TCLP extraction; 180 days to analysis SW-846 7471A; 28 days to TCLP extraction; 28 days to analysis ILM05.4; 180 days to TCLP extraction for all metals except mercury; 26 days to TCLP extraction for mercury	
					TCLP SVOCs				SW-846 1311/3510C/8270C or USEPA CLP SOM01.2	SW-846 8270C; 8081A; 14 days to TCLP extraction; 7 days to preparative extraction; 40 days to analysis SOM01.2; 12 days to TCLP extraction; 5 days to preparative extraction; 40 days to analysis	
					TCLP Pesticides				SW-846 1311/3510C/8081A or USEPA CLP SOM01.2		

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					TCLP Herbicides				SW-846 1311/3510C/8151A or USEPA CLP SOM01.2	14 days to TCLP extraction 7 days to preparative extraction 40 days to analysis	
					TCLP VOCs	Grab	40 mL G vial w/Teflon septa	4	SW-846 1311/5030C/8260B or USEPA CLP SOM01.2	<u>SW-846 8260B</u> ; 14 days to TCLP extraction; 14 days to analysis <u>SOM01.2</u> ; 10 days to TCLP extraction; 10 days to analysis	Cool 4°C
					Total PCBs	Grab	1L AG	2	SW-846 8082 or USEPA CLP SOM01.2	<u>SW-846 8082</u> ; 14 days to extraction; 40 days to analysis <u>SOM01.2</u> ; 5 days to extraction; 40 days to analysis	Cool 4°C
					Dioxins/Furans (from suspect waste materials, i.e., area north of the capacitor disposal area)	Grab	1L AG	1	SW846-8290 or USEPA CLP DLM02.0	<u>SW-846 8290</u> ; 30 days to extraction; 45 days to analysis <u>DLM02.0</u> ; 10 days to extraction; 30 days to analysis	Cool 4°C

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Post-Excavation Confirmation Soil Samples	Excavation area bottom and sidewalls	Confirm that contaminated soil has been removed	Approximately 550	1 sample per 30ft of excavation sidewall and 1 sample per 900ft <sup>2</sup> of excavation bottom	VOCs	Grab	EnCore™ sampler	2	SW-846 5035/8260B or USEPA CLP SOM01.2	48 hours to preservation by laboratory; <u>SW-846 8260B</u> ; 14 days to analysis <u>SOM01.2</u> ; 10 days to analysis	Cool 4°C
					TCL SVOCs	Grab	32oz. CWM	2	SW-846 3550C/8270C or USEPA CLP SOM01.2	<u>SW-846 8270C</u> ; <u>8081A</u> ; <u>8082</u> ; 14 days to extraction; 40 days to analysis <u>SOM01.2</u> ; 10 days to analysis	Cool 4°C
					TCL Pesticides	Grab			SW-846 3550C/8081A or USEPA CLP SOM01.2	40 days to analysis	Cool 4°C
					Total PCBs	Grab			SW-846 3550C/8082 or USEPA CLP SOM01.2	<u>SOM01.2</u> ; 10 days to extraction; 40 days to analysis	Cool 4°C
					Cyanide	Grab			SW-846 Method 9014 or USEPA CLP ILM05.4	<u>SW-846 9014</u> ; 14 days <u>ILM05.4</u> ; 12 days	Cool 4°C
					TAL Metals	Grab			SW-846 3050/6010B/7471A or USEPA CLP ILM05.4	<u>SW-846 6010B</u> ; 180 days to digestion; 180 days to analysis <u>SW-846 7471A</u> ; 28 days to digestion; 28 days to analysis <u>ILM05.4</u> ; 180 days for all metals except mercury; 26 days for mercury	Cool 4°C

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**Table 4-1: Sampling and Analysis Matrix**

<i>Sample</i>	<i>Location</i>	<i>Rationale</i>	<i>Estimated Number of Samples</i>	<i>Frequency</i>	<i>Parameter(s)</i>	<i>Sample Type</i>	<i>Type of Bottles<sup>1,2</sup></i>	<i>Number of Bottles<sup>1,2</sup></i>	<i>Methodology</i>	<i>Holding Time<sup>3</sup></i>	<i>Preservative</i>
					Dioxins/Furans	Grab	4oz. AG	1	SW846-8290 or USEPA CLP DLM02.0	<u>SW-846 8290</u> ; 30 days to extraction; 45 days to analysis <u>DLM02.0</u> ; 10 days to extraction; 30 days to analysis	Cool 4°C
Post-LTTD Treatment Samples	LTTD-treatment pad stockpiles or bins	Confirm that soil treated in the onsite LTTD unit has been treated adequately to be used as onsite backfill	Approximately 260	1 sample per day's treated volume	VOCs	Grab	EnCore™ sampler	2	SW-846 5035/8260B or USEPA CLP SOM01.2	48 hours to preservation by laboratory; <u>SW-846 8260B</u> ; 14 days to analysis <u>SOM01.2</u> ; 10 days to analysis	Cool 4°C
					TCL SVOCs	Grab	32oz. CWM	2	SW-846 3550C/8270C or USEPA CLP SOM01.2	<u>SW-846 8270C</u> , <u>8081A</u> , <u>8082</u> ; 14 days to extraction; 40 days to analysis <u>SOM01.2</u> ; 10 days to extraction; 40 days to analysis	Cool 4°C
					TCL Pesticides	Grab			SW-846 3550C/8081A or USEPA CLP SOM01.2		Cool 4°C
					Total PCBs	Grab			SW-846 3550C/8082 or USEPA CLP SOM01.2		Cool 4°C
					Cyanide	Grab			SW-846 Method 9014 or USEPA CLP ILM05.4	<u>SW-846 9014</u> ; 14 days <u>ILM05.4</u> ; 12 days	Cool 4°C

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**Table 4-1: Sampling and Analysis Matrix**

<i>Sample</i>	<i>Location</i>	<i>Rationale</i>	<i>Estimated Number of Samples</i>	<i>Frequency</i>	<i>Parameter(s)</i>	<i>Sample Type</i>	<i>Type of Bottles<sup>1,2</sup></i>	<i>Number of Bottles<sup>1,2</sup></i>	<i>Methodology</i>	<i>Holding Time<sup>3</sup></i>	<i>Preservative</i>
					TAL Metals	Grab			SW-846 3050/6010B/7471A or USEPA CLP ILM05.4	SW-846 6010B; 180 days to digestion; 180 days to analysis SW-846 7471A; 28 days to digestion; 28 days to analysis ILM05.4; 180 days for all metals except mercury; 26 days for mercury	Cool 4°C
					Dioxins/Furans	Grab	4oz. AG	1	SW846-8290 or USEPA CLP DLM02.0	SW-846 8290; 30 days to extraction; 45 days to analysis DLM02.0; 10 days to extraction; 30 days to analysis	Cool 4°C
Backfill/Topsoil	Off-Site Borrow Source(s)	Establish that backfill and topsoil material brought on-Site for restoration activities are not hazardous to human health or the environment	Determined in the field based on the amount of offsite source material required. It is expected that all backfill requirements will be met using soil treated onsite in the LTTD unit.	1 sample per 5000yd <sup>3</sup>	VOCs	Grab	EnCore™ sampler	2	SW-846 5035/8260B	48 hours to preservation by laboratory; SW-846 8260B; 14 days to analysis SOM01.2; 10 days to analysis	Cool 4°C
					TCL SVOCs	Composite	32oz. CWM	2	SW-846 3550C/8270C	SW-846 8270C; 14 days to analysis	Cool 4°C
					TCL Pesticides	Composite			SW-846 3550C/8081A	8081A; 14 days to analysis	Cool 4°C

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<i>Sample</i>	<i>Location</i>	<i>Rationale</i>	<i>Estimated Number of Samples</i>	<i>Frequency</i>	<i>Parameter(s)</i>	<i>Sample Type</i>	<i>Type of Bottles<sup>1,2</sup></i>	<i>Number of Bottles<sup>1,2</sup></i>	<i>Methodology</i>	<i>Holding Time<sup>3</sup></i>	<i>Preservative</i>
					Total PCBs	Composite			SW-846 3550C/8082	days to extraction; 40 days to analysis <u>SOM01.2</u> : 10 days to extraction; 40 days to analysis	Cool 4°C
					pH	Composite			SW-846 9045C	14 days	Cool 4°C
					Cyanide	Composite			SW-846 Section 7.4.3.2/ Method 9014	<u>SW-846 9014</u> : 14 days <u>ILM05.4</u> : 12 days	Cool 4°C
					TAL Metals	Composite			SW-846 3050/6010B/7471A	<u>SW-846 6010B</u> : 180 days to digestion; 180 days to analysis <u>SW-846 7471A</u> : 28 days to digestion; 28 days to analysis <u>ILM05.4</u> : 180 days for all metals except mercury; 26 days for mercury	Cool 4°C
					Radiological Parameters (to include uranium, thorium, and radium)	Composite	32oz. CWM	1	EPA 901.1 (ore equivalent gamma spectroscopy method)	180 days	None

**Notes:**

<sup>1</sup> Bottle types – AG: Amber Glass; HDPE: High Density Polyethylene Plastic; CWM: Clear wide mouth glass jar with Teflon lid

<sup>2</sup> All bottles should be filled completely with zero head space

<sup>3</sup> From Verified Time of Sample Collection for SW-846 methods; from Verified Time of Sample Receipt for CLP methods

<sup>4</sup> For TCLP analysis on aqueous samples, the laboratory will filter the sample and the aqueous filtrate becomes the TCLP extract. If the aqueous sample contains visible solids, then a percent dry solids determination is performed. If the percent dry solids is >0.5% (about 50g of solids in 1L of aqueous sample), a TCLP extraction will be performed if there is at least 130g of solids present. The aqueous filtrate and TCLP extract are combined for analysis.

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## **5.0 FIELD OPERATIONS DOCUMENTATION**

### **5.1 Non-Conformance/QC Reporting**

A non-conformance is defined as an identified or suspected deficiency or discrepancy with regard to an approved document (e.g., improper sampling procedures); an item where the quality of the end product itself or subsequent activities using the document or item could be affected by the deficiency; or an activity that is not conducted in accordance with the established plans or procedures.

Any staff member engaged in project work that discovers or suspects a non-conformance is responsible for initiating a non-conformance report to the CQCSM. The CQCSM will evaluate each non-conformance report and provide a disposition which describes the actions to be taken. The non-conformance/QC report to be used is included in Appendix 5.

The Project Manager will verify that no further project work dependent on the nonconforming item or activity is performed until approval is obtained and the non-conformance is properly addressed. If the non-conformance is related to material, the Project Manager will be responsible for identifying the nonconforming item (if practical) and indicating that it is nonconforming and is not to be used.

A copy of each non-conformance report will be included in the project file. Copies of all non-conformances shall be maintained by the CQCSM.

### **5.2 Field Log Book**

Field logbooks are water resistant, bound notebooks that provide the means of recording data collecting activities. Sufficient information will be recorded in the logbooks to permit reconstruction of all site-sampling activities conducted. Information recorded on other project documents will not be repeated in the logbooks except in summary form where determined necessary. All field logbooks will be kept in the possession of field personnel responsible for completing the logbooks, or in a secure place when not being used during fieldwork. Upon completion of the field activities, all logbooks will be submitted to the USACE to become part of the final project file.

Entries into the logbook will be made in ink and will contain a variety of information, including:

- Date, start time, field observations, weather conditions, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry.
- Names of visitors to the Site and the purpose of their visit.
- Measurements made and samples collected, including the equipment used to make measurements, along with the date of calibration and record of results.
- Detailed description of the location of the sampling station.
- Time of sampling, sample description, depth or location at which the sample was collected, its type, volume, and number of containers.
- Field duplicate samples collected.
- Deviations from the approved procedures during collection, preparation, documentation, or transportation.
- Bottle lot numbers, reagent information, and any waste produced.

### **5.3 Photographic Record**

Photographic documentation will be taken throughout the remedial action. Photographs will be arranged in a photo log for submission with the project final report.

### **5.4 Sample Documentation**

Sample custody during the field activities will be performed in three phases. The first custody phase encompasses sample collection, pre-laboratory treatment procedures, and packaging and shipping procedures. The second custody phase involves sample shipment, where mode of shipment, airbill numbers, dates, and times are documented. The third custody phase involves the custody procedures employed by the laboratory. All three phases of sample custody will be performed in accordance with QAPP Worksheet #26 and #27 to provide that:

- Samples are uniquely identified.
- The correct samples are tested and are traceable to their source.
- Important sample characteristics are preserved.
- Samples are protected from loss or damage.
- A record of sample integrity is established and maintained through the entire custody process.

#### 5.4.1 Sample Numbering System

A unique sample numbering scheme will be used to identify each sample designated for laboratory analysis. The purpose of this numbering scheme is to provide a tracking system for the retrieval of analytical and field data on each sample. Sample identification numbers will be used on all sample labels or tags, field data sheets or logbooks, chain of custody (COC) records, and all other applicable documentation used during the project.

A listing of all sample identification numbers will be maintained in the field logbook. The project database will be populated with sample numbers and information consistent with information found here and in the QAPP. The sample identification scheme to be used is as follows:

**Solid waste characterization samples** will be labeled: CD-WC-xx

- CD-WC                      Project site and sample type (Cornell-Dubilier waste characterization sample)
- xx                              Sequential sample number

**Wastewater characterization samples** will be labeled: CD-WW- xx

- CD-WW                      Project site and sample type (Cornell-Dubilier waste water sample)
- xx                              Sequential sample number

**Post-excavation confirmation samples** will be labeled: CD-Grid-xx-Location

- CD                              Project site (Cornell-Dubilier)
- Grid                              Grid from which sample was collected
- xx                              Sequential sample number
- Location                      Location of sample as follows: FL = excavation bottom, SW = south  
sidewall,  
  
WW = west sidewall, EW = east sidewall, NW = north sidewall

**Post-LTTD treatment samples** will be labeled: CD-PT-xx-date

- CD-PT                      Project site and sample type (Cornell-Dubilier post-treatment)
- xx                              Batch of treated material being tested
- Date                              Sample collection date in MMDDYY format

**Offsite backfill and topsoil samples** will be labeled: CD-BF- xx or CD-TS- xx

- CD-BF/CD-TS                      Project site and sample type (Cornell-Dubilier backfill sample or Cornell-Dubilier topsoil sample)
- xx                                      Sequential sample number

#### **5.4.2 Sample Labels and/or Tags**

In accordance with QAPP Worksheet #27, immediately after a sample has been collected, a self-adhesive identification label will be completed in indelible ink and neatly affixed to the outside of the sample container. After completing the sample label, it will be covered with clear tape for protection. The following information will be legibly entered on all sample labels:

- Contractor name
- Sample type (grab or composite)
- Analysis/method to be performed
- Type of chemical preservative present in the container
- Site name
- Date and time of sample collection
- Sample identification number
- Sampler's name or initials

Sample logbooks and COC records will contain the same information as the labels affixed to the sample containers. These records will record all information related to the sampling effort and the process employed.

#### **5.4.3 Chain of Custody Records**

The COC guidelines create an accurate written record that can be used to trace possession and handling of the sample from the moment of its collection through analysis. COC forms will be completed for each sample at the time of collection and will be maintained while shipping the sample to the laboratory in accordance with QAPP Worksheet #27.

#### **5.4.4 Custody Seals**

Shipping containers must be sealed with custody seals for shipment to the laboratory. When samples are shipped, two or more custody seals are to be placed on each shipping container, with at least one at the front and one on the side, located in a manner that would indicate if the container were opened in transit. Wide, clear packaging tape should be placed over the custody seals to ensure that the seals are not accidentally broken during shipment. Upon receipt of the sample coolers, the sample custodian must check and confirm that all custody seals on the coolers are intact.

## **5.5 Corrections to Documentation**

All original data recorded in field notebooks and on sample identification labels, chain-of-custody records, and sample receipt forms are written in waterproof ink. These documents are not to be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on a document, the individual entering the information/data will make the corrections. A single solid line (in indelible ink, preferably) will be made through the errant entry. Under no circumstances shall a correcting fluid (e.g., White-Out®) be used or any erasures made. The erroneous information should not be obliterated. Each correction shall be dated and initialed by the individual making the correction.

Should any improper correction of returned paperwork (e.g., laboratory-signed COCs, analytical reports) be suspected, it should be brought to the attention of the Site Project Manager immediately for further action, as necessary.

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## **6.0     SAMPLE PACKAGING AND SHIPPING**

Custody of samples will be maintained throughout the shipment of samples to the selected laboratory. All samples will be packaged and shipped at the end of each day unless other arrangements are made with the laboratory. No samples will be shipped on Friday unless prior arrangements are made with the laboratory for Saturday sample receipt. Samples will be packaged and delivered directly to the laboratory in accordance with the procedure in QAPP Worksheet #27.

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## **7.0     CONTRACTOR QUALITY CONTROL**

Contractor quality control (CQC) is the means by which the contractor ensures that the field activities comply with the requirements of the contract. The CQCSM will ensure that Severson maintains quality throughout all fieldwork by means of a three-phase process performed onsite for each definable work element. The three phases of control include the preparatory phase, the initial phase, and the follow-up phase. Examples of the inspection checklists for the three-phase procedures have been provided in Appendix 5 of this SAP. These activities are further defined below.

### **7.1     Preparatory Phase**

The preparatory phase of the CQC program will be performed prior to the initiation of remedial activities or phases of remedial activities, after all required plans, documents, and materials are accepted and approved, and will consist of a meeting conducted by the Severson CQCSM. This meeting will have minutes recorded and will occur prior to the initiation of sampling activities or phases of remedial activities. The meeting may include:

- Review of the planned activities to assure field personnel and subcontractors are aware of overall data quality objectives, the specific type of data being collected, and specific sampling and data analysis requirements.
- Review of all required forms.
- Review of equipment decontamination procedures.
- Review of proper IDW management and storage.
- Review of proper sample collection, packaging, and documentation.
- Review of field equipment and support material checklists.
- Confirm any required preliminary tasks are complete.
- Review safety issues and analyze for any potential hazards.
- Review of other issues as deemed necessary by the Severson CQCSM.

The USACE will be notified at least 48 hours in advance of the preparatory control phase. The results of the preparatory phase actions will be documented by minutes prepared by the CQCSM and attached to the Daily Quality Control Report.

### **7.2     Initial Phase**

The Severson CQCSM shall oversee and confirm compliance with the FSP and QAPP at the initiation of each definable work feature. The CQCSM will observe and document compliance and/or deviations from the approved FSP and QAPP. Minutes of this phase will be prepared and attached to the daily QC report. Activities will include:

- Oversight of sampling and field activities to assure compliance with contract terms.
- Oversight of sample acquisition, labeling, and shipping.
- Oversight of sampling equipment decontamination.
- Inspection of all required documentation, including field notebooks and chain of custody forms to assure completeness, consistency, and accuracy.
- Completion of QC Inspection Report and Task-Specific QC Checklists (copies included in Appendix 3 of this SAP).
- Verification that activities are conducted according to the SSHERP to assure worker and community safety.

The USACE will be notified at least 48 hours in advance of the beginning the initial phase. The initial phase will be repeated for each new work crew to work onsite, or at any time acceptable quality standards are not being met.

### **7.3 Follow-Up Phase**

The Severson CQCSM will provide daily inspections to ensure compliance with the FSP and QAPP until completion of each definable work element. This daily inspection will document deficiencies noted during the initial phase, communicate any such deficiencies to both field personnel and the project manager, provide appropriate methods to correct the deficiencies, and follow up with the affected personnel to assure corrective measures are implemented. This phase will include the completion of the daily chemical quality control report (DCQCR), a copy of which is included in Appendix 5 and further discussed in QAPP Worksheet #33.

**8.0     SITE REPORTING AND DAILY CHEMICAL QUALITY CONTROL REPORTS**

The Severson Project Manager, USEPA, and USACE will receive several types of management reports. These reports are summarized in QAPP Worksheet #33.

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## **9.0     CORRECTIVE ACTIONS**

Corrective actions will be undertaken when a non-conforming condition is identified. A non-conforming condition occurs when QC objectives for precision, accuracy, completeness, representativeness, or comparability are not met, or when procedural practices or other conditions are not acceptable. A report will be filed which documents the problems encountered and the corrective action implemented (Nonconformance/Quality Control Report; Appendix 5). Further details on corrective action responses are included on QAPP Worksheet #32.

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## 10.0 REFERENCES

Cornell Dubilier Electronics Site Information Sheet, USEPA, July 2006.

Field Sampling Procedures Manual, NJDEP, August 2005.

Identification and Listing of Hazardous Waste, 40CFR261, 1999.

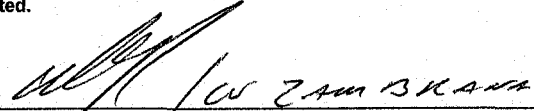
NJDEP SRP Regulations and Guidance, Last Updated 5/12/99; <http://www.state.nj.us/dep/srp/regs/scc/>

PCB Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions, 40CFR761, 1999.

Project Specifications for Cornell-Dubilier Electronics Superfund Site – OU2, USACE, 2008.

Requirements for the Preparation of Sampling and Analysis Plans (EM 200-1-3), USACE, February 2001.

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<b>TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE</b> (Read instructions on the reverse side prior to initiating this form)				DATE 02/11/2009		TRANSMITTAL NO. 01351-53		
<b>SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS</b> (This section will be initiated by the contractor)								
TO: Environmental Residency US Army Corps of Engineers 214 State Highway 18 East Brunswick, NJ 08816			FROM: Severson Environmental Services Inc. 2749 Lockport Road Niagara Falls, NY 14305		CONTRACT NO. W912DQ-04-D-0023 0011		CHECK ONE: <input checked="" type="checkbox"/> THIS IS A NEW TRANSMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL _____	
SPECIFICATION SEC. NO. (Cover only one section with each transmittal) 01351			PROJECT TITLE AND LOCATION Cornell Dubilier OU2 Soils (LTTD) 333 Hamilton Boulevard, SP, NJ 07080			CHECK ONE: THIS TRANSMITTAL IS FOR <input type="checkbox"/> FIO <input checked="" type="checkbox"/> GA <input type="checkbox"/> DA <input type="checkbox"/> CR		
ITEM NO.  a.	DESCRIPTION OF ITEM SUBMITTED (Type size, model number/etc.)  b.	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See instruction no. 8)  c.	NO. OF COPIES  d.	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE  g.	VARIATION (See Instruction No. 6)  h.	FOR CE USE CODE  i.
				SPEC. PARA. NO.  e.	DRAWING SHEET NO.  f.			
15	PCB Protection Plan	WORK PLAN	6	1.3		A	N	
REMARKS				I certify that the above submitted items have been reviewed in detail and are correct and in the strict conformance with the contract drawings and specifications except as otherwise stated.				
				 NAME AND SIGNATURE OF CONTRACTOR				
<b>SECTION II - APPROVAL ACTION</b>								
ENCLOSURES RETURNED (List by item No.)			NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY			DATE		

**Cornell-Dubilier Electronics Superfund Site  
Operable Unit 02 – Soil Remediation  
South Plainfield, New Jersey  
Contract Number – W912DQ-04-D-0023 TO-0011**

**PCB Protection Plan**

**January 21, 2009**

**Sevenson Environmental Services, Inc.**  
**PCB Protection Plan**

**1.0 Purpose**

The purpose of this plan is to outline the hazards of polychlorinated biphenyls (PCBs) to site personnel and the public. It will also detail the PCBs control program.

**2.0 PCBs Hazard**

PCBs are a mixture of individual chemicals which are no longer produced in the United States but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions (chloracne) in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the EPA. A PCBs fact sheet is in Appendix A.

The two means of exposure are inhalation and skin contact.

The four major operations where there is the potential for exposure are:

- Contaminated material excavation and screening;
- Management of contaminated material stockpiles;
- Operation of the Low Temperature Thermal Desorption (LTTD) unit; and
- Decontamination of personnel, equipment, and/or machinery.

**3.0 Control Program**

The PCBs control program is designed to prohibit contact and inhalation includes:

- Worker training
- Medical surveillance
- Personal protective equipment
- Personal and perimeter air monitoring
- Dust control
- Decontamination procedures

**3.1 Worker Training**

All site workers who have the potential for exposure to PCBs will participate in the following training programs:

- 40 hour OSHA HAZWOPER and, if necessary, an 8 hour refresher.
- Site specific – this would include a review of the Site Specific Safety and Health Plan, work practices, activity hazard analyses, results of air monitoring program, and concerns including safety deficiencies and accidents.
- Daily safety meetings – all site personnel are required to attend and items to be discussed would include review of the day's activities and their associated hazards and controls, safety and health concerns, and action items.

- Hazard communication – as part of this OSHA required training, emphasis will be placed on the health effects of PCBs, exposure potential, and control programs.

### 3.2 Public Information

A Quality of Life Plan which outlines the effects of the work and PCBs have on the general public has been prepared. This plan also describes performance standards which are designed to protect the public. A copy of the plan will be made available to the public. In addition Severson will provide information to the EPA and USACOE regarding work being performed, air monitoring results, and implementation of various control programs. This information at the EPA's discretion can then be made available to the public.

### 3.3 Medical Surveillance

All workers who have the potential to be exposed to PCBs will participate in Severson's medical surveillance program.

The purposes of this program are to determine:

- The capability of the worker to perform the work. This will be accomplished by the physical examination by the physician and the review of the medical and work histories.
- The ability to wear respiratory protection. The pulmonary function test and X-ray will assist the physician in making this determination.
- Whether there are any prior physical and/or health conditions which may be advise affected by the work and/or exposure to the contaminants. The physician will primarily review the results of the liver enzyme blood tests and pre work serum PCB level.
- Whether any physical or biological systems have been affected by the work. As part of the medical surveillance program, pre and past work serum PCBs will be determined.

### 3.4 Personal Protective Equipment

The proper wearing of personal protective equipment is an integral component of the worker protection program. An evaluation of the potential for PCBs exposure and the proper ensemble of personal protective equipment has been made. The initial level of protection for workers exposed to PCBs is Level C which includes the wearing of protective clothing to protect against contact and respirators to prevent the inhalation hazard. The personal protective equipment will be continuously evaluated and may be modified depending upon actual work conditions.

### 3.5 Personal and Perimeter Air Monitoring

The air monitoring program will determine both worker and public exposure to PCBs. The worker air monitoring program includes:

- Personal monitoring for PCBs. This monitoring will be accomplished using established NIOSH methods and will determine the total concentration of PCBs to which a worker is exposed.
- Real time dust monitoring. The results of this will be used as an indicator of worker's exposure to PCBs and effectiveness of dust control.

Perimeter air monitoring will be used to determine the potential for public exposure to PCBs. This monitoring includes:

- Perimeter monitoring for PCBs. This monitoring will be accomplished using an established EPA method and will determine the total concentration of PCBs to which the public is potentially exposed.
- Real time dust monitoring. The results of this will be used as an indicator of PCB exposure and the effectiveness of dust control.

### 3.6 Dust Control

PCBs have the ability to be absorbed onto dust. Therefore, the reduction of dust levels is an important part of the PCBs control program.

Dust control measures which can be used to reduce emissions include:

- Adding moisture to the soil.
- Covering soil or soil piles with polyethylene.
- Using a misting system with an odor neutralizing additive.
- Applying foams to the soil or soil piles.
- Reducing the speed of equipment which disturbs the soil.
- Reducing the number of pieces of equipment.
- Installing barriers to reduce wind speed.
- Limiting the rate of excavation.
- Removing accumulated dirt and soil from problem areas, and/or cover, enclose, or isolate dust generating areas/surfaces to shield them from wind and sunlight.
- Increase level of worker awareness and instruct them in implementation of any new or modified operating procedures.
- Perform routine audits of dust suppression methods and work areas for dust surfaces.

### 3.7 Decontamination Procedures

Both equipment and personal decontamination will occur using standard methods.

Personal decontamination will occur in the contaminant reduction zone. The following is an outline of this procedure:

- Wash boots and gloves in decontamination solution.
- Remove boots.
- Remove outer gloves.
- Remove protective suit.
- Remove respirator.
- Remove inner gloves.

During equipment contamination, workers will be wearing Level C protection. All equipment and machinery that were in the Exclusion Zone leaving the site will be decontaminated.

#### 4.0 Summary

A comprehensive PCBs protection program will be established at the Cornell – Dubilier Site. This program will be regularly reviewed by the Health and Safety Manager, Site Safety and Health Officer, and Site Superintendent to determine its effectiveness and whether any modifications have to be made to it.

## APPENDIX A

# PCB Fact Sheet

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ToxFAQs™ for

Polychlorinated Biphenyls  
(PCBs)

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February 2001

This fact sheet answers the most frequently asked health questions about polychlorinated biphenyls (PCBs). For more information, you may call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

**HIGHLIGHTS:** Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the Environmental Protection Agency (EPA).

## **What are polychlorinated biphenyls (PCBs)?**

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

## **What happens to polychlorinated biphenyls (PCBs) when they enter the environment?**

PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.

PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.

PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.

PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

**How might I be exposed to polychlorinated biphenyls (PCBs)?**

PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.

PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.

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**How can polychlorinated biphenyls (PCBs) affect my health?**

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

**How likely are polychlorinated biphenyls (PCBs) to cause cancer?**

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

**How do polychlorinated biphenyls (PCBs) affect children?**

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported. In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

**How can families reduce the risk of exposure to polychlorinated biphenyls (PCBs)?**

You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.

Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.

Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.

If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

**Is there a medical test to show whether I've been exposed to polychlorinated biphenyls (PCBs)?**

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

**Has the federal government made recommendations to protect human health?**

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

**Source of Information**

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

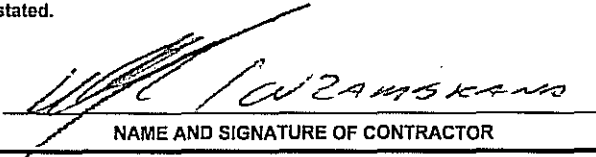
**Where can I get more information?**

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

**For more information, contact:**

Agency for Toxic Substances and Disease Registry  
Division of Toxicology  
1600 Clifton Road NE, Mailstop E-29  
Atlanta, GA 30333  
Phone: 1-888-422-8737  
FAX: (404) 498-0057

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE (Read Instructions on the reverse side prior to initiating this form)					DATE 03/30/2009		TRANSMITTAL NO. 01351-14.2		
SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (This section will be initiated by the contractor)									
TO: Environmental Residency US Army Corps of Engineers 214 State Highway 18 East Brunswick, NJ 08816			FROM: Severson Environmental Services Inc. 2749 Lockport Road Niagara Falls, NY 14305		CONTRACT NO. W912DQ-04-D-0023 0011		CHECK ONE: <input checked="" type="checkbox"/> THIS IS A NEW TRANSMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL		
SPECIFICATION SEC. NO. (Cover only one section with each transmittal) 01351			PROJECT TITLE AND LOCATION Cornell Dubiller OU2 Soils (LTDD) 333 Hamilton Boulevard, SP, NJ 07080				CHECK ONE: THIS TRANSMITTAL IS FOR <input type="checkbox"/> FIO <input checked="" type="checkbox"/> GA <input type="checkbox"/> DA <input type="checkbox"/> CR		
ITEM NO.	DESCRIPTION OF ITEM SUBMITTED (Type size, model number/etc.)		MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See instruction no. 8)	NO. OF COPIES	CONTRACT REFERENCE DOCUMENT SPEC. PARA. NO. DRAWING SHEET NO.		FOR CONTRACTOR USE CODE	VARIATION (See instruction No. 6)	FOR CE USE CODE
a.	b.		c.	d.	e.	f.	g.	h.	i.
18	Site Safety and Health Plan Rev 2		WORK PLAN	6	1.2		A	N	FA
REMARKS * Revise for LTDD / EM 385-A-1 & new activities. Accepted on March 6, 09 * Provide Three copies to USEPA * Provide Copies to USACE KCD					I certify that the above submitted items have been reviewed in detail and are correct and in the strict conformance with the contract drawings and specifications except as otherwise stated.  [Signature] NAME AND SIGNATURE OF CONTRACTOR				
SECTION II - APPROVAL ACTION									
ENCLOSURES RETURNED (List by item No.)			NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY Patrick Nejad, COR [Signature]			DATE 30 March 09			

<b>TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE</b> (Read instructions on the reverse side prior to initiating this form)					DATE 03/30/2009		TRANSMITTAL NO. 01351-14.2	
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18	Site Safety and Health Plan Rev 2	WORK PLAN	6	1.2		A	N	
REMARKS					I certify that the above submitted items have been reviewed in detail and are correct and in the strict conformance with the contract drawings and specifications except as otherwise stated.   NAME AND SIGNATURE OF CONTRACTOR			
<b>SECTION II - APPROVAL ACTION</b>								
ENCLOSURES RETURNED (List by item No.)			NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY				DATE	

**Cornell-Dubilier Electronics Superfund Site**  
**Operable Unit 02 – Soil Remediation**  
**South Plainfield, New Jersey**  
Contract Number – W912DQ-04-D-0023 TO-0011  
**Accident Prevention Plan**  
**Revision 2**  
March 6, 2009

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*Appendix D – Safety and Health Forms*

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1.0 Signature Sheet

Cornell-Dubilier Electronics Superfund Site  
Operable Unit 02 – Soil Remediation

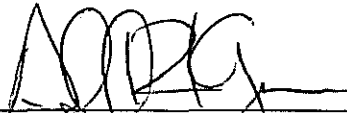
South Plainfield, New Jersey


Contract Number – W912DQ-04-D-0023 TO-0011

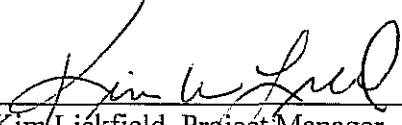
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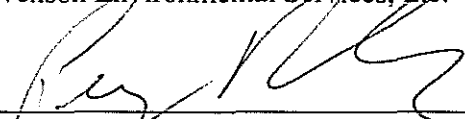
Revision 2

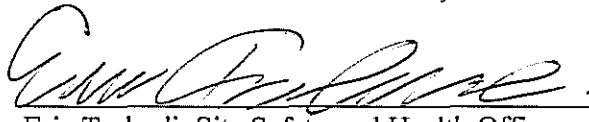
March 6, 2009


  
Alfred LaGreca, Corporate Project Manager  
Sevenson Environmental Services, Inc. 3/25/09  
Date

  
Paul Hitcho Ph.D., CIH, Safety and Health Manager  
Sevenson Environmental Services, Inc. 3-25-09  
Date

  
Kim Lickfield, Project Manager  
Sevenson Environmental Services, Inc. 25 MAR 09  
Date

  
Perry Novak, Site Superintendent/Competent Person  
Sevenson Environmental Services, Inc. 3/25/09  
Date

  
Eric Tschudi, Site Safety and Health Officer  
Sevenson Environmental Services, Inc. 3/30/09  
Date

  
Patrick Carr, Construction Quality Control System Manager  
Sevenson Environmental Services, Inc. 3/25/09  
Date

## 2.0 Background Information

Sevenson Environmental Services, Inc., (Sevenson) is under contract (W912DQ-04-D-0023, TO-0011) to the US Army Corps of Engineers (USACE), Kansas City District Pre-Placed Remedial Contract (PRAC), to perform remedial action at the Cornell-Dubilier Electronics Superfund Site, South Plainfield, New Jersey.

The remedial action effort will focus on the remediation of the Cornell-Dubilier Electronics Superfund Site, Operable Unit 02 (OU-2), in the Borough of South Plainfield, Middlesex County, New Jersey. OU-2 consists of contaminated facility site soils. Work includes excavation of 107,000 cubic yards (CY) of contaminated soils and subsurface debris; onsite treatment of excavated soils amenable to treatment by low temperature thermal desorption (LTTD) followed by backfilling of excavated areas with treated soils; transportation of contaminated soil and debris not suitable for onsite LTTD treatment to an offsite facility for disposal; installation of a multi-layer cap or hardscape; installation of engineering controls; restoration; sampling and analysis of soil, water air, and building material; and other activities necessary for complete and proper remediation of the site.

Sevenson's last three-year safety statistics are presented in Table 1.

Table 1-Safety Statistics				
Year	Recordable Injury Rate	Lost Time Injury Rate	EMR	Man-hours Worked
2008	2.16	0.46	0.91	1,301,261
2007	1.73	0.26	0.77	1,499,784
2006	1.55	0.25	0.78	1,545,425

The phases of work and hazardous activities requiring an Activity Hazard Analysis are:

- Site mobilization
- Excavation, screening, stockpiling, and movement of contaminated material
- Construction of Low Temperature Thermal Desorption (LTTD) unit
- Operation of the LTTD
- Equipment decontamination
- Site restoration, backfilling, and grading
- Site demobilization

## 3.0 Statement of Safety and Health Policy

Sevenson maintains comprehensive programs to prevent health or safety risks. The quality of work life has a high priority in our organization, which means that all employees must regard health and safety protection responsibilities seriously. Our goal is

to minimize injury or illness and business interruption due to accidents, fire, or other hazards.

To fulfill this goal, management is committed to:

- a. Maintaining programs that identify and assess occupational health and safety risks.
- b. Providing the funds to implement health and safety programs that control and minimize risks to employees.
- c. Controlling and reducing employee exposure to all hazardous agents in accordance with government regulations.
- d. Informing employees of health and safety risks and ensuring that all members of the organization understand the company's health and safety measures.
- e. Communicating with customers, governmental agencies, and the public on matters that affect employee and public health and safety.
- f. Planning, designing, and constructing a safe and healthful work environment at all job sites.
- g. Developing processes and establishing operating methods that minimize health and safety risks.
- h. Encouraging all employees to work in a safe and healthful manner and providing training directed toward this objective, when needed.

#### 4.0 Responsibilities and Lines of Authorities

While the Severson Safety and Health Department directs and supervises the overall Safety, Health and Environmental Program, the responsibility for Safety and Health extends throughout our organization from top management to every employee. For this reason, it is each person's duty to notify the management personnel if a hazardous condition is identified and to make a "stop work" call when the condition represents an immediate danger to life or health, until the SSHO can make a further determination. The following are the Severson project personnel positions and responsibilities for this project. Refer to *Figure 1 – "Organizational Chart"*.

- **Corporate Project Manager:** Alfred LaGreca
- **Project Manager:** Kim Lickfield
- **Project Superintendent:** Perry Novak
- **Safety and Health Manager:** Paul Hitcho, Ph.D., CIH
- **Occupational Physician:** Dr. Peter Greaney
- **Site Safety and Health Officer:** Eric Tschudi
- **Alternate SSHO:** TBD
- **First Aid/CPR Qualified Personnel:** Eric Tschudi, TBD
- **Subcontractors:** TBD

#### **4.1 Corporate Project Manager**

The Corporate Project Manager directs and manages all aspects of the project in compliance with all contract and technical requirements. The Corporate Project Manager will monitor and control all subcontractors to achieve optimal performance and ensure safe, high quality performance that complies with all contract requirements.

#### **4.2 Project Manager**

The Project Manager reports to the Corporate Project Manager. His responsibilities include coordinating project activities with the Project Superintendent and serving as the primary liaison with the Contracting Officer Representative. The Project Manager prepares all correspondence, submittals, and other documentation required for the project; coordinates schedules; and administers the contract. The Project Manager prepares reports and documentation, supervises inspection personnel, and reviews and approves procurement and subcontract activities.

#### **4.3 Project Superintendent**

The Project Superintendent supervises and coordinates all construction crew activities relating to site preparation, excavation, shipping, and restoration. The Project Superintendent has the operational responsibility for the implementation of the SSHP on this project. This includes establishing an attitude of concern for safety matters by initiating prompt corrective action of hazards brought to his attention, and ensuring that the project safety and health requirements are initiated and observed by all project personnel. The Project Superintendent is the Competent Person for the operations at the site.

The Superintendent plans and requires that all work be performed in compliance with this SSHP, the Severson Corporate Health and Safety Plan and/or the client's safety program including all applicable local, state, and federal regulations. He will impress upon all subcontractors' supervisory personnel a sense of responsibility and accountability of each individual to maintain a safe workplace and to work in a safe manner.

#### **4.4 Safety and Health Manager (SHM)**

Responsible to the Corporate Officer in charge, Paul Hitcho Ph.D., CIH, the Safety and Health Manager formulates, administers and coordinates programs for the company to reduce the risk of loss due to employee injury, regulatory non-compliance, general liability, fire, theft, or damage. The Safety and Health Manager will develop written detailed policies and procedures covering elements in the Safety, Health and Environmental Program. The Safety and Health Manager's work history/resume and certifications are in Appendix A. The Safety and Health Manager will:

- Be responsible for the development, implementation, oversight, and enforcement of the SSHP.
- Sign and date the SSHP prior to submittal
- Conduct initial site-specific training.
- Be present onsite during the first day of remedial activities and at the startup of each new major phase.

- Visit the site as needed and at least once per field event to audit the effectiveness of the SSHP and be available for emergencies.
- Provide onsite consultation as needed to ensure that the SSHP is fully implemented.
- Coordinate any modifications to the SSHP with the Site Superintendent, the SSHO, and the Contracting Officer's Representative.
- Provide continued support for upgrading/downgrading the level of personal protection.
- Be responsible for evaluating air monitoring/sampling data and recommending changes to engineering controls, work practices, and Personal Protective Equipment (PPE).
- Review accident reports and results of daily inspections.
- Serve as a member of the Severson's quality control staff.
- Conduct monthly site inspection and report findings to USACE during the period of work activities onsite.

#### **4.5 Certified Industrial Hygienist (CIH)**

The Certified Industrial Hygienist for this project will be the Safety and Health Manager. The CIH will assist in the development, implementation, and enforcement of the SSHP, provide consultation, review air monitoring data; and assist in safety audits and document review. Visit the site as needed and at least once per quarter for the duration of activities.

#### **4.6 Occupational Physician**

Under the direction of the Safety and Health Manager, the Occupational Physician will be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1910.120(f), and 1926.53(f). The Occupational Physician will provide the Safety and Health Manager with a written opinion of each employee's ability to perform hazardous remedial work.

#### **4.7 Site Safety and Health Officer (SSHO)**

The SSHO for this project is Mr. Eric Tschudi, his work history/resume and certifications are in Appendix A. Under the direction of the Safety and Health Manager, the SSHO will be responsible for the implementation of this SSHP and for the daily coordination of safety activities with the Project Superintendent and the Contracting Officer Representative to ensure that the planned work objectives reflect adequate safety and health considerations. The SSHO will submit to the Contracting Officer Representative Certificates of Worker/Visitor Acknowledgements for site personnel prior to initial entry onto the site. He will maintain a complete copy of this plan (and its supplements and addenda) at the site during all field activities and assure that all workers and visitors are familiar with it. He will perform site-specific training and briefing sessions for employee(s) prior to the start of field activities at the site and a briefing session each day before starting work. He will ensure the availability, proper use and maintenance of specified personal protective equipment, decontamination equipment, and other safety

and health equipment. He will maintain a high level of safety awareness among team members and communicate pertinent matters to them promptly. The SSHO will:

- Assist and represent the Safety and Health Manager in on-site training and the day-to-day on-site implementation and enforcement of the accepted SSHP.
- Be assigned to the site on a full time basis for the duration of field activities excluding site grading, filling, paving, site restoration, and demobilization. The SSHO shall be at the site on a part-time basis during these activities. The SSHO may have other duties besides safety and health related duties, but health and safety duties shall come first. If operations are performed during more than one shift per day, an SSHO shall be present for each shift.
- Have the authority to ensure site compliance with specified safety and health requirements, Federal, state and OSHA regulations; and all aspects of the SSHP. This includes, but is not limited to, activity hazard analyses, air monitoring/sampling, use of PPE, decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls; the emergency response plan, confined space entry procedures, spill containment program, and preparation of records. This will be accomplished by performing a daily safety and health inspection and documenting results on the Daily Safety Log.
- Have authority to stop work activities if unacceptable health or safety conditions exist, and take necessary action to re-establish and maintain safe working conditions.
- Consult and coordinate any modifications to the SSHP with the Safety and Health Manager, the Site Superintendent, and the Contracting Officer's Representative.
- Serve as a member of the Severson's quality control staff on matters relating to safety and health. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.
- Conduct accident investigations and prepare accident reports. ENG Form 3394 USACE Accident Investigation form will be filled out and submitted to USACE Safety Officer for pen and ink changes, and final submitted within 5 working days.
- Review results of daily quality control inspections and document safety and health findings in the Daily Safety Log. Prepare and submit Weekly Safety Reports.
- Coordinate with Site Management and the Safety and Health Manager, recommend corrective actions for identified deficiencies, and oversee the corrective actions.
- Maintain a deficiency tracking log per EM 385-1-1, paragraph 01.A.12(d), on a health and safety bulletin board as specified in EM 385-1-1, paragraph 01.A.06.

- Maintain applicable safety reference material on the job site.
- Participate in initial pre-entry briefing and conduct periodic safety briefings.

#### **4.8 Alternate Site Safety and Health Officer**

An alternate SSHO will be appointed for Mr. Tschudi. The alternate will assume all responsibilities of the SSHO in the event of his absence.

#### **4.9 Safety and Health Technicians**

For each work crew in the exclusion zone, one person designated as a Safety and Health Technician shall perform air monitoring, decontamination, and safety oversight activities on behalf of the SSHO. They shall have appropriate training equivalent to the SSHO in each specific area for which they have responsibility and shall report to and be under the supervision of the SSHO.

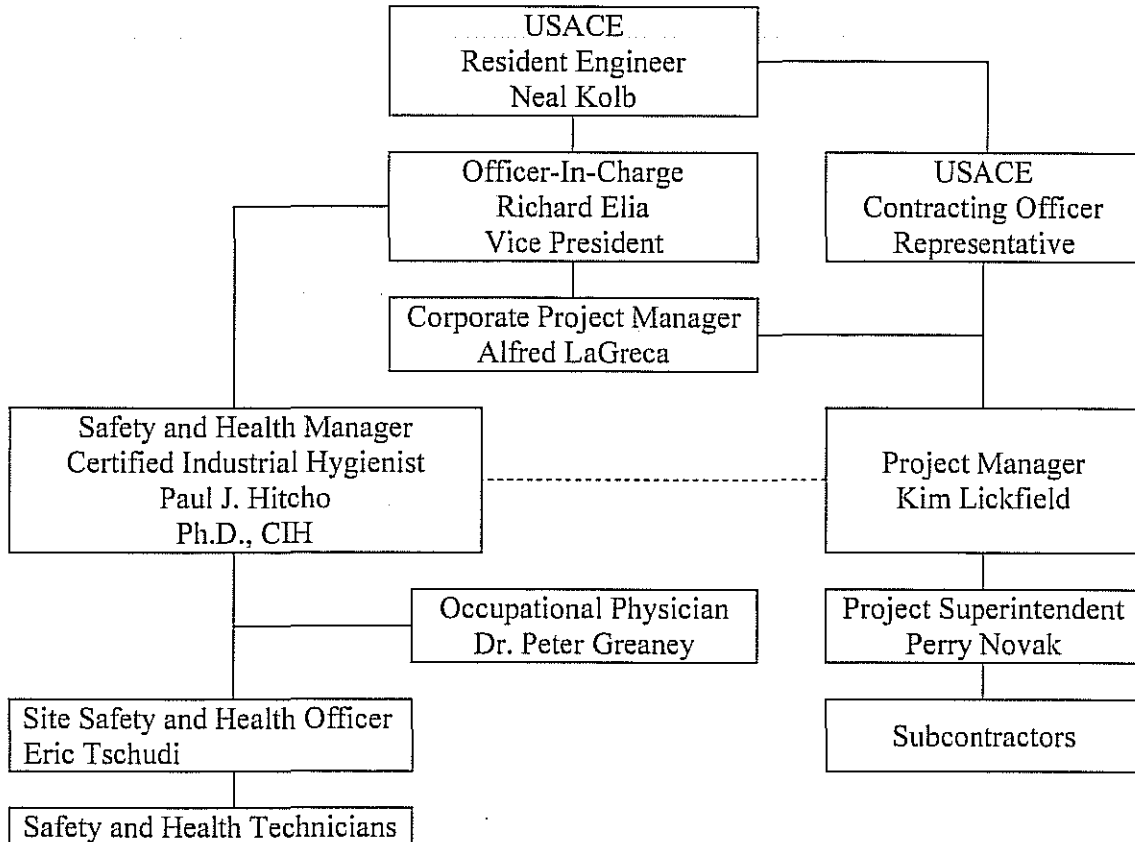
#### **4.10 Subcontractors**

Subcontractors utilized during remedial activities at the Cornell-Dubilier Electronics Superfund Site are covered by this SSHP and will be provided a copy of the plan prior to commencing work. The Severson SSHO will verify that subcontractor employee training, medical clearance, and respirator fit test records are current and will monitor and enforce compliance with the established plan and standard operating procedures. As with all site personnel, subcontractors will be briefed on the provisions of this plan and attend all daily toolbox and weekly safety meetings.

Severson will continually monitor a subcontractor's safety performance. Severson will observe subcontractors for hazards or unsafe practices that are both readily observable and occur in common work areas. The SSHO will note subcontractor work practices on the daily Safety and Health report. If non-compliance or unsafe conditions or practices are observed, the subcontractor safety representative will be notified and corrective action will be required. The subcontractor will determine and implement necessary controls and corrective actions. If repeat non-compliance/unsafe conditions are observed, the subcontractor will be required to stop affected work until adequate corrective measures are implemented.

The major subcontractor for this project will be the operator of the LTDD Unit. They will be required to prepare an amendment to this plan which outlines the procedures for the safe operation of the unit.

Figure 1  
Organizational Chart



## 5.0 Subcontractors and Suppliers

Subcontractors utilized during remedial activities at the Cornell-Dubilier Electronics Superfund Site are covered by this SSHP and will be provided a copy of the plan prior to commencing work. The Severson SSHO will verify that subcontractor employee training, medical clearance, and respirator fit test records are current and will monitor and enforce compliance with the established plan and standard operating procedures. As with all site personnel, subcontractors will be briefed on the provisions of this plan and attend all daily toolbox and weekly safety meetings.

Severson will continually monitor a subcontractor's safety performance. Severson will observe subcontractors for hazards or unsafe practices that are both readily observable and occur in common work areas. The SSHO will note subcontractor work practices on the daily Safety and Health report. If non-compliance or unsafe conditions or practices are observed, the subcontractor safety representative will be notified and corrective action will be required. The subcontractor will determine and implement necessary controls and corrective actions. If repeat non-compliance/unsafe conditions are observed, the subcontractor will be required to stop affected work until adequate corrective measures are implemented.

The major subcontractor for this project will be the operator of the Low Temperature Thermal Desorption (LTTD) Unit. They will be required to prepare an amendment to this plan which outlines the procedures for the safe operation of the unit.

## **6.0 Training**

### **6.1 Initial Training**

Prior to commencement of onsite field activities, all site employees will attend a site-specific safety and health training session. This session will be conducted by the SSHO or designee, to ensure that personnel are familiar with the requirements of this Accident Prevention Plan (APP). The initial session will consist of the contents of this APP and specific procedures developed for the project. The SSHO or designee will also provide initial site-specific training for replacement employees.

As a minimum the site-specific training will include:

- Explanation of the APP.
- Health and Safety Personnel and Organization.
- Special attention to signs and symptoms of overexposure to known and suspected site contaminants.
- Health effects of site contaminants.
- Air monitoring description.
- Physical hazards associated with the project.
- Selection, use, and limitations of available safety equipment and proper procedures for its use.
- Personal hygiene and decontamination.
- Respirator fit testing.
- PPE fitting to determine proper size for individuals.
- Site rules and regulations.
- Work zone establishment and markings.
- Site communication and the "Buddy System".
- Emergency preparedness procedures.
- Equipment decontamination.
- Medical monitoring procedures.
- Review applicable Sevenson Standard Operating Procedures.
- Site Specific Hazard Communication.
- Lead Awareness Training

## 6.2 Mandatory Training

Site personnel will be required to have various training courses to perform their work in a safe and efficient manner. The following list outlines the mandatory training requirements.

- 40 hour HAZWOPER training and three days of actual field experience under the direct supervision of a trained experienced supervisor.
  - All Site personnel assigned to the project that will perform work in either the Contamination Reduction Zone, Exclusion Zone, or handle hazardous materials that have been prepared for shipment stored in the Support Zone.
- 24 hour HAZWOPER training and one day of actual field experience under the direct supervision of a trained experienced supervisor
  - Workers on site only occasionally for specific limited tasks and who are unlikely to be exposed over permissible exposure limits.
- 8 hour HAZWOPER annual refresher training
  - All Site personnel that has completed a HAZWOPER training course shall receive at a minimum 8 hours of refresher training annually.
- 8 hour HAZWOPER Supervisor training
  - Site management and supervisors directly responsible for, or who supervise employees engaged in hazardous waste operations shall receive a minimum of 8 additional hours of training on the safety and health program and associated employee training program, personal protective equipment (PPE) program, spill containment program, and health hazard monitoring procedures and techniques.
- Transportation of Hazardous Materials training as describe in 49 CFR 172 Subpart H
  - This training will be task specific for any employee who handles, prepares, offers, or accepts hazardous materials. This training is required initially and every 3 years after that, unless there are changes in rules, regulations, manifests, or procedures.
- Crane Operator
  - No one will be authorized to operate a crane at the Site unless they receive and maintain a certification from the National Commission for the Certification of Crane Operators, or an approved, equivalent certification program.
- Confined Space Entry Training
  - Any person who enters into a Permit Required Confided Space must receive entrant training prior to entering the confined space. This will be required annually.

- Any person who is designated at a Permit Required Confined Space Attendant must receive Attendant training prior to being assigned as an attendant. This will be required annually.
- Any supervisor requesting personnel to enter into a Permit Required Confined Space shall receive supervisor training prior to authorizing Permit Required Confined Space work. This training will be required annually.
- Lockout Tagout Training
  - All employees will receive initial and annual training for Site procedures for the control of hazardous energy controls. This will be conducted at least annually.
- Excavation and Trenching Training
  - Supervisory and other essential personnel engaged in excavation activities are required to complete Competent Person Training. This training provides knowledge about soil analysis and classification, use of protective systems, and the requirements of Excavation Standards. This training will be conducted at least annually.
- First Aid and Cardiopulmonary Resuscitation (CPR) Training
  - At least two site personnel will be required to complete first aid and CPR training and receive the appropriate certification. CPR certification is renewed annually; first aid certification is renewed every three years. All first aid/CPR training is American Red Cross, American Heart Association approved or in accordance with OSHA standards. Additionally, First Aid/CPR qualified personnel will have received blood borne pathogen training as required by 29 CFR 1910.1030.

## 7.0 Safety and Health Inspections

Safety and Health inspections will be conducted to discover, through specific, methodical auditing, checking, or inspection procedures, conditions and work practice that lead to job accidents and illnesses.

The Health and Safety Manager shall be responsible for ensuring that inspections are conducted at the frequency stated, reviewing the Daily Safety Logs for completeness, thoroughness, and trends; performing monthly project inspections; and training site personnel on proper inspection techniques. The SSHO shall be responsible for ensuring that daily inspections are conducted, reviewing the inspections findings and corrective actions for applicability and thoroughness, and providing the site management personnel with a summary of inspection findings each month.

The SSHO will develop a safety report based on the deficient inspection items noted during the inspection and conveying the deficiencies to the CQCSM via a Non-compliance Identification / Corrective Action (NICA) Report (refer to Appendix H of the Quality Control Plan). The CQCSM will enter the deficiencies in a master deficiency-tracking log. The CQCSM and the SSHO will discuss the existence of the

deficiency with the appropriate work force individual(s) responsible for its correction. A corrective plan of action is developed and implemented following USACE approval. Deficiencies are tracked in accordance with the Quality Control Plan.

## **8.0 Safety and Health Expectations, Incentive Programs, and Compliance**

### **8.1 Expectations**

The safety and health of workers, clients, the public, and the protection of the environment are fundamental responsibility assumed by Severson under this contract. Severson will:

- Promote project safety with an objective of zero lost-time accidents.
- Manage activities in a proactive way that effectively increases the protection of site workers, the public, and the environment.
- Reduce safety and health risk by identifying and eliminating hazards from site activities.

Carry out site activities in a manner that complies with all applicable safety, health, and environmental laws and regulations.

### **8.2 Incentive Program**

It is expected that all employees perform their assigned tasks in a safe and healthful manner. Therefore, safe work performance is a key element in an employee's review of his/her suitability for continued employment.

In addition to individual incentives there are also awards given to crews who have completed a project without a lost time accident or illness. These awards have included lunches, dinners, jackets, hats, and sweatshirts.

### **8.3 Compliance**

Compliance with the requirements of applicable Federal, State, and local laws will be accomplished through a combination of written programs, employee training, workplace monitoring, and system enforcement. Continued and regular inspections by supervisors and safety personnel, as well as upper management with total involvement in the safety program will produce an atmosphere of voluntary compliance. However, disciplinary action for violations of project requirements will be taken, when necessary.

All site personnel and visitors entering a Contamination-Reduction Zone or Exclusion Zone at the site will be required to read and verify compliance with the provisions of this APP and specific appendices. In addition, visitors will be expected to comply with relevant OSHA requirements such as medical surveillance, training, and personal protective equipment. In the event that a person does not adhere to the provisions of the APP, he/she will be requested to leave the work area. All nonconformance incidents will be recorded in the Daily Safety Log.

The SSHO will conduct surveillance on a daily basis of all work areas and subcontractor's activities to ensure that safety and health is properly implemented. In addition, any reports from employees concerning unsafe work practices, acts, or

conditions will be investigated promptly. Unsafe acts, practices, or conditions will be reported to the responsible supervisor at the time of inspection.

The safe and efficient work practices of this company require a spirit of teamwork and cooperation from all employees. Also required are uniform standards of expected behavior. Employees who refuse or fail to follow the standard set forth by this plan, the Severson Corporate Health and Safety Plan and/or regulatory standards, will subject themselves to disciplinary action up to, and including discharge. In cases not specifically mentioned, employees are expected to use good judgment, stop work, and refer any questions to their supervisors.

As part of the Quality Control program at the Site, a Safety Matrix will be kept and updated as necessary to ensure site specific safety programs (e.g., medical surveillance, site or task specific training, air monitoring) are complete or in place at each quality control phase meeting for the definable features of work outlined in Section 14.

### 9.0 Accident Reporting

Incident reporting will ensure an immediate report on all incident/accidents and provide an effective follow-up for corrective action in order to eliminate unsafe practices and unsafe conditions. A Severson **Incident/Accident Form** must be completed within 24 hours of the Incident/Accident. This report is utilized in the event of injuries, off-site releases, utility breaks, or accidents. Immediately following the incident/accident, the Site Superintendent and the SSHO will initiate an Incident/Accident Investigation. A verbal notification of the incident or accident will be made immediately to the COR. For recordable injuries and illnesses, and property damage accidents resulting in at least \$2,000 in damages, the USACE ENG 3384 Accident Report will be completed and submitted to the COR within two calendar days of the accident.

"Near misses" will be documented by the SSHO and discussed at the morning safety briefings to educate the work force to potentially hazardous operations or practices.

Copies of Severson's jobsite specific OSHA 300 Log that summarize recordable injuries and lost-time accidents will be submitted to the Contracting Officer monthly.

General Site and accident photos will be taken, captioned, recorded, and stored according to EPA Guidance: Digital Camera Guidance for EPA Civil Inspections and Investigations, US. EPA – Office of Compliance (Mail code: 2223A) National Compliance Monitoring Policy Branch 1200 Pennsylvania Avenue, N.W. Washington, D.C. 20460 EPA-305-F-06-002.

### 10.0 Medical Support

The SSHO will be trained in CPR and First Aid and have first aid kits for use in a medical emergency. First Aid Kits will be located in the main support area, Contamination Reduction Zone and at the work activity locations. Eyewash stations will be available at the Contamination Reduction Zone. Eyewash stations will be of the pressurized, 15-minute discharge type. On-site employees have a basic knowledge of first aid and will assist the Site Superintendent and SSHO. Community emergency services (EMS, Fire, and Police) will be notified immediately if their resources are needed on site.

If necessary, the injured or sick party will be taken to John F. Kennedy Medical Center--Please refer to *Figure 3 – "Route to Hospital Map"*, for directions to the area hospital. Route to the area hospital will be posted and easily visible at all times.

## **11.0 Personal Protective Equipment**

This section provides an outline of the PPE and guidelines that will be implemented to minimize chemical, physical, and biological exposures and accidents during remedial activities. Where engineering controls and job hazard analyses do not eliminate all job hazards, employees will (where appropriate) wear PPE.

These include items such as, hard hats, face shields, safety goggles, glasses, hearing protection, foot guards, gloves, reflective vests, etc. The SSHO will ensure that equipment selected will meet the following requirements:

- It will be appropriate for the particular hazard.
- It will be maintained in good condition.
- It will be properly stored when not in use to prevent damage or loss.
- It will be kept clean, fully functional, and sanitary.
- Must meet all applicable ANSI standards.

Personal clothing and jewelry can present additional safety hazards. Supervisors will ensure that workers wear appropriate clothing, which will not interfere with the PPE. All PPE will be selected in accordance with 29 CFR 1910.132. Severson will provide proper PPE to all employees. All protective clothing will be properly used, stored, selected, and maintained.

Government personnel will be supplied with all required personal protective equipment (excluding air-purifying negative-pressure respirators and safety shoes, which will be provided by the individual visitors). Severson will provide basic training in the use and limitations of PPE to government personnel.

### **11.1 PPE Hazard Assessment**

Selection of the appropriate PPE is a complex process, which should take into consideration a variety of factors. Key factors involved in this process are identification of the hazards, or suspected hazards, routes of potential exposure to employees (inhalation, skin absorption, ingestion, and eye or skin contact), and the performance of the PPE materials (and clothing seams) in providing a barrier to these hazards. The amount of protection provided by PPE is material-hazard specific. That is, protective equipment materials will protect well against some hazardous substances and poorly, or not at all, against others. In many instances, protective equipment materials cannot be found that will provide continuous protection from the particular hazardous substance. In these cases, the breakthrough time of the protective material shall exceed the work duration.

Other factors in this selection process to be considered are matching the PPE to the employee's work requirements and task-specific conditions. The durability of PPE materials, such as tear strength and seam strength, should be considered in relation to the employee's tasks. The effects of PPE in relation to heat stress and task duration are a

factor in selecting and using PPE. In some cases, layers of PPE may be necessary to provide sufficient protection, or to protect expensive PPE inner garments, suits, or equipment.

The following are guidelines, which Severson uses to select PPE. Based on the site characterization and analysis performed during the remedial activities, a combination of PPE has been selected from the different protection levels (i.e., A, B, C, D Modified, or D) as being suitable to the hazards of the work to be performed. Section 3.0 of this plan characterizes and analyzes the chemical, physical, and biological hazards; specific tasks/operations; routes of exposure; and concentrations of contaminants. Characteristics, capabilities, and limitations are summarized in this section.

- **Level A:** The highest level of skin, eye, and respiratory protection (Level A PPE is not anticipated on this project).
- **Level B:** Should be worn when the highest level of respiratory protection is needed, but a lower level of skin protection is needed, compared to that of level A (Level B PPE may be required during remediation of the area around SB39 located on the Excavation Plan Contract Drawing G-06, June 2008).
- **Level C:** Should be worn when the criteria for using air-purifying respirators are met, and a lesser or the same level of skin protection is needed, compared to that of level B.
- **Level D Modified:** Should be worn when respiratory protection is not warranted but minimal dermal protection is necessary.
- **Level D:** Level D provides minimal protection against chemical hazards. A work uniform consisting of coveralls and/or long pants and sleeves may be worn in any area without the potential for significant respiratory or skin contact hazards.

Personal Protective Equipment alone should not be relied on to provide protection against hazards, but should be used in conjunction with guards, engineering controls, and sound work practices.

## **11.2 Head Protection**

All personnel will wear a hard hat that meets the requirements and specifications in ANSI Safety Requirements for Industrial Head Protection Z89.1-1969. Exceptions to this requirement are personnel in the site office and rest and eating areas.

## **11.3 Hand Protection**

Outer gloves used on the Site for remedial activities will be either chemical resistant or general purpose. The appropriate glove will be determined by the SSHO for a specific work task. Chemical resistant gloves will be selected using appropriate chemical degradation guides. Leather work gloves will be worn when work activities require the handling of sharp and rough-surfaced objects.

Welder's gloves or any other special type of gloves are considered outer gloves and are to be worn over inner gloves. These special outer gloves will be stored on-site and will be disposed of properly as PPE waste. Inner gloves will always be chemical resistant, will

be selected using appropriate chemical degradation guides and will be disposed of as PPE waste.

#### **11.4 Eye/Face Protection**

Contact lenses are allowed in the Exclusion Zone and Contamination Reduction Zone only after the SSHO has performed a safety assessment to ensure the use of contacts are not prohibited by information contained in material safety data sheets or chemical information sheets. Eye/face protection will be worn by all personnel in the Contamination Reduction Zone and Exclusion Zone. Double eye protection will be required when power-washing equipment during decontamination. All eye/face protection provided will be ANSI Z87-1989 approved.

#### **11.5 Footwear**

Footwear will be steel-toed safety boots/composite and will be worn for all field activities. Chemical-resistant outer boot covers are to be worn in the Exclusion Zone, Contamination Reduction Zone. Boot racks will be provided in the Contaminated Reduction Zone for drying of outer boots.

#### **11.6 Respiratory Protection**

To control and or minimize the threat of occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective of this program will be to prevent atmospheric contamination. This will be accomplished as far as feasible by accepted engineering control measures (for example, dust suppression). When effective engineering controls are not feasible, or while they are being instituted, appropriate respiratory protection will be used. A respiratory protection program will be implemented that is compliant to the requirements of 10 CFR 20 Subpart H, "Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas" and 29 CFR 1910.134, "Respiratory Protection." Respiratory protection equipment will be NIOSH-approved, and respirator use will conform to ANSI Z88.2.

Respirators will be provided when such equipment is necessary to protect the health of the employee. Severson will:

- Provide the respirators, which are applicable and suitable for the purpose intended.
- Be responsible for maintaining a written Respiratory Protective Program in accordance with 29 CFR 1910.134. The employee will use the provided respiratory protection in accordance with instructions and training received.
- Respirators will be selected on the basis of hazards to which the worker is exposed.
- The user will be instructed and trained in the proper use of respirators and their limitations.
- Respirators will be surveyed for unconditional use during breaks and remain in a predetermined area at the Contamination Reduction Zone with the filter cartridges left in place. However, at shift's end, respirator cartridges will be removed from the respirators and placed into the waste prior to the respirator

being surveyed for unconditional use and allowed to exit the Contamination Reduction Zone.

- Respirators will be regularly cleaned and disinfected.
- Respirators will be stored in a convenient, clean, and sanitary location.
- Respirators used routinely will be inspected during cleaning. Worn or deteriorated parts will be replaced. Respirators for emergency use, such as self-contained devices, will be thoroughly inspected at least once a month and after each use.
- Appropriate surveillance of work area conditions and degree of employee exposure or stress will be maintained.
- There will be regular inspections and evaluations to determine the continued effectiveness of the program.
- Employees will not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. A physician will determine whether an individual is physically fit to wear a respirator. The physician's clearance allows the worker to don a respirator and work in conditions of high ambient temperatures. Heat stress will be closely monitored by the SSHO.

Each respirator will be individually assigned and not interchanged between workers without cleaning and sanitizing. The cartridges/filters will be changed at the first sign of breakthrough based on contaminant warning properties or if the user experiences excessive breathing resistance. The SSHO will make final determination of the frequency of respirator cartridge/filter change-out. Respirators will be cleaned and stored in an uncontaminated atmosphere after each use. Used cartridges will be disposed of with spent PPE. Self-contained breathing apparatus/supplied-air respirators will be inspected before and after use by the user and at least once monthly by the SSHO.

All employees who have the potential of wearing a respirator will be fit-tested to ensure they utilize the proper size respirator. Severson will arrange for fit testing. The fit test is conducted according to the manufacturer's suggestions and will be quantitative. A quantitative fit test machine will be used to perform the test. A fit factor of 500 must be obtained by the wearer in order to successfully pass the fit test. As per OSHA regulations, personnel who are unable to pass a fit test will not enter a work area when respiratory protection is required. In addition, facial hair is prohibited from the respirator seal area. Any person with facial hair will not be permitted to enter a work area where respiratory protection is required, regardless of the fit test results. Documentation of the fit testing will be maintained on-site.

## **11.7 Levels of Protection**

The level of protection must correspond to the level of hazards known or suspected for the specific work activity.

### **11.7.1 Level B**

Level B equipment, used as appropriate, is as follows:

- Positive pressure, full face piece, self-contained breathing apparatus (SCBA) or positive pressure supplied air respirator with escape SCBA (NIOSH-approved)
- Disposable coverall (Tyvek, Polycoated Tyvek or Saranex)
- Outer gloves: neoprene or nitrile
- Inner gloves: latex or nitrile
- Chemical resistant or disposable overboots.
- Steel-toed safety boots
- Hard hat

#### **11.7.2 Level C**

Level C equipment, used as appropriate, is as follows:

- Full-face, air purifying, cartridge-equipped respirators (NIOSH-approved) utilizing Organic Vapor and/or P-100 (HEPA) filters (half-face if approved by SSHA). Cartridges and/or filters must be replaced as needed and, as a minimum, changed daily
- Disposable coverall (Tyvek, Polycoated Tyvek or Saranex)
- Outer gloves: leather, cotton, neoprene or nitrile
- Inner gloves: latex or nitrile
- Chemical resistant or disposable overboots
- Steel-toed safety boots
- Hard hat
- Safety glasses (if half-mask is utilized)
- Splash guards (worn during high pressure washing activities)

#### **11.7.3 Modified Level D**

Modified Level D equipment, used as appropriate, is as follows:

- Disposable coveralls – Tyvek or Polycoated or equivalent for wet work (equipment decontamination) or as required
- Outer gloves – leather, cotton, nitrile as required
- Inner gloves – nitrile surgical with cotton liner (cotton liner optional)
- Boot covers – Tyvek or equivalent
- Outer boots – rubber or latex disposable
- Safety boots
- Hard hat
- Reflective vest

- Safety glasses – with face shield as required

SSHO shall determine the need for upgrade or downgrade of PPE levels based on a conservative interpretation of information provided by air monitoring data and other appropriate information.

The SSHO's Daily Safety Log will list protective ensemble(s) in use for each task.

#### 11.7.4 Level D

Level D equipment, used as appropriate, is as follows:

- Work uniform (Long pants and Shirt)
- Reflective vests
- Hard hat
- Steel-toed safety boots (with disposable overboots, as required)
- Safety glasses
- Leather or heavy cloth gloves (as needed)

#### 11.8 Initial Levels of Protection

Based upon the nature of the remedial activities to be performed at the Site, the initial levels of protection to be used are outlined in *Table 2, "Initial Levels of Protection"*. This table lists each work task and the initial level of protection. The initial level of protection is defined as that level in which work commences.

Table 2 - Initial Levels of Protection		
Task	CPC	Level of PPE
Site Preparation/Mobilization	None	Level D
Civil Surveying	None	Level D
Chemical Sampling	Reg. Tyvek	Level C
Work Zone Construction	Reg. Tyvek	Level D Modified
Excavation	Reg. Tyvek	Level C
Soil Removal and Stockpiling	Reg. Tyvek	Level C
Soil Treatment	Reg. Tyvek	Level C
Site Restoration and Backfill	None	Level D
Equipment Decontamination	Poly coated Tyvek	Level C
Demobilization	None	Level D

#### 12.0 Plans (Programs, Procedures) Required by the EM 385-1-1

##### 12.1 Layout Plans

A comprehensive Work Plan has been prepared under separate cover and provides information pertaining to the Site Layout.

##### 12.2 Emergency Response Plan

Sevenson's emergency response plan is located in the SSHP (Appendix B).

### **12.3 Hazard Communication Program**

Sevenson's Hazard Communication Program is in the Corporate Health and Safety Plan which is a separate document and is considered to be a part of this Plan. Material Safety Data Sheets for chemicals of concern and materials brought onto the Site are located in the SSHO's office trailer.

### **12.4 Respiratory Protection Plan**

Sevenson's Respiratory Protection Plan is in the Corporate Health and Safety Plan.

### **12.5 Lead Abatement Plan**

Lead exposure is a concern at the Site during the excavation and treatment of soils. All Site employees will receive lead awareness training as part of their initial site training. Occupational samples will be collected from the workers breathing zone as discussed in the SSHP's air monitoring section. Employees will have their blood levels checked as part of the medical surveillance program. If breathing zone samples indicate an exposure at the action level workers blood lead will be checked in accordance with OSHA's lead standard.

### **12.6 Confined Space Program**

Sevenson's Confined Space Program is located in Appendix E.

### **12.7 Hazardous Energy Control Plan/Lockout Tagout**

Sevenson's Lockout/Tagout Program is in the Corporate Health and Safety Plan.

### **12.8 Critical Lift Procedures**

Sevenson's Critical Lift Program is in the Corporate Health and Safety Plan.

### **12.9 Contingency Plan for Severe Weather**

In the event of severe weather, the Site Superintendent and/or the SSHO have the authority to stop operations and direct evacuation procedures. All equipment will be secured and grounded. After the storm, a visual inspection will be performed by the Superintendent and/or the SSHO to check for damage and hazards. These will be performed before any work is resumed. If damage or hazards are noted, Sevenson personnel will evaluate the conditions and implement corrective actions to repair the damage or eliminate the hazard. These actions will begin as soon as possible and will take precedence over other site activities.

### **12.10 Access and Haul Road Plan**

A comprehensive Work Plan has been prepared under separate cover and provides information pertaining to access and haul roads or routes.

### **12.11 HTRW – Site Specific Health and Safety Plan**

A Site Specific Health and Safety Plan has been prepared for this project and is located in Appendix B.

## 12.12 Prevention of Alcohol and Drug Abuse

Sevenson is committed to providing a safe, efficient, and productive work environment for all employees. Using or being under the influence of drugs or alcohol on the job may pose serious safety and health risks. To help ensure a safe and healthful working environment, employees may be asked to provide body substance samples (such as urine and/or blood) to determine the illicit or illegal use of drugs and alcohol. Refusal to submit to drug testing may result in disciplinary action, up to and including termination of employment.

Under the Drug-Free Workplace Act, an employee who performs work for a government contract or grant must notify Sevenson of a criminal conviction for drug-related activity occurring in the workplace. The report must be made within five days of the conviction. Employees with questions on this policy or issues related to drug or alcohol use in the workplace should raise their concerns with their supervisor or the Human Resources Department without fear of reprisal.

Copies of the above drug testing policy (Sevenson's Substance Abuse Program) will be provided to **all employees**. Employees will be asked to sign an acknowledgement form indicating that they have received a copy of the drug testing policy. Questions concerning this policy or its administration should be directed to the Human Resources Department.

## 12.13 Fall Protection Plan

To access high and low places on jobsites a variety of equipment may be used such as ladders, scaffolding, suspended platforms, aerial lifts, stairways, and climbing lines. The use of these access systems often presents fall hazards. In addition, employees may be exposed to falls while working on elevated structures, climbing onto and off of equipment, and even while walking by falling through holes or by slipping or tripping.

To protect employees when they are exposed to fall hazards, some form of fall protection must be used. The most common forms of fall protection are guardrails, personal fall arrest systems, hole covers, and safety nets. Any one, or all of these forms of fall protection may be used on construction worksites. The current OSHA standards also require that employees receive training regarding fall protection issues, and that the training is documented. An alternate fall arrest program may be implemented in cases where none of the traditional methods of fall protection are feasible. Components of our fall protection plans are listed below:

**Personal Fall Arrest System** - The three main parts of a personal fall arrest system are the full body harness, the lanyard/lifeline, and a suitable anchorage. Particular attention must be paid to the anchorage point(s) to ensure that they are capable of supporting 5,000 lb. (22.2 kN) or two times the maximum load on an engineered system.

**Guardrail Systems** - Guardrail systems consist of a toprail, midrail, and if necessary a toeboard. Guardrail systems can be made of various materials, and they must be capable of supporting a 200-pound force.

**Training** - All employees must receive training on the nature of the fall hazards at the site and on how to avoid falls. Employees should be familiar with the use of all personal fall arrest systems and must wear the equipment when necessary.

The requirements of all applicable OSHA regulations notwithstanding, the minimum fall protection requirements on our projects may include the following:

- All fall protection systems must meet the requirements of Part 1926, Subpart M.
- For situations where lifelines are interrupted, double lanyards are necessary to ensure that the worker is continuously protected from falling by attaching one lanyard ahead of the discontinuity prior to unhooking the trailing lanyard.
- Climbing on forms, false work, or the structure to gain access to work areas is expressly prohibited. However, it is not intended to prohibit the use of ladders for access to work areas, provided the operation is in compliance with OSHA Part 1926 Subpart X and other relevant requirements.
- Where scaffolds are necessary to provide temporary access to work areas, they must be in compliance with §1926.451. Scaffolds must include a toprail, midrail, and toeboard in compliance with 1926.451, on all open sides and ends. Personal fall arrest systems meeting the criteria of Part 1926 Subpart M are required to protect workers during installation and removal of the railings, and in situations where physical restrictions preclude installation of a standard railing.
- All workers in approved personnel aerial lifts must use a personal fall arrest system meeting the criteria of Part 1926 Subpart M, with the lanyard attached to the boom or basket, as required by OSHA 1926.556.
- Because falls from structural members constitute a serious and clearly recognizable hazard, fall protection, if necessary, for all steel or concrete beams and other structural elements must be in place prior to removal. This fall protection will consist of personal fall arrest systems, safety nets, or other means meeting the requirements of Part 1926 Subpart M.

Instances in which it is impossible to provide fall protection for workers are rare. Where an individual worker must rig the fall protection system, and it cannot be accomplished from an aerial lift or by tying-off to the existing structure, momentary exposure to a fall hazard may be unavoidable. It is essential that adequate planning of construction procedures minimize such occurrence of unprotected exposure to fall hazards. It is equally essential that the fall protection systems utilized actually enhance safety, rather than creating a secondary hazard.

#### **12.14 Night Operations Lighting Plan**

The SSHO will ensure proper lighting is provided at the Site during night operations. Lighting requirements will be addressed during the preparatory phase meeting for each operation. The minimum lighting requirements listed in EM 385-1-1 Table 7-1 will be maintained at all times during nighttime operations.

EM 385-1-1  
15 Sep 08

TABLE 7-1

## MINIMUM LIGHTING REQUIREMENTS

Facility or function	Illuminance – lx (lm/ft <sup>2</sup> )
Accessways	
- general indoor	55 (5)
- general outdoor	33 (3)
- exitways, walkways, ladders, stairs	110 (10)
Administrative areas (offices, drafting and meeting rooms, etc.)	540 (50)
Chemical laboratories	540 (50)
Construction areas	
- general indoor	55 (5)
- general outdoor	33 (3)
- tunnels and general underground work areas (minimum 110 lx required at tunnel and shaft heading during drilling, mucking, and scaling)	55 (5)
Conveyor routes	110 (10)
Docks and loading platforms	33 (3)
Elevators, freight and passenger	215 (20)
First-aid stations and infirmaries	325 (30)
Maintenance/operating areas/shops	
- vehicle maintenance shop	325 (30)
- carpentry shop	110 (10)
- outdoors field maintenance area	55 (5)
- refueling area, outdoors	55 (5)
- shops, fine detail work	540 (50)
- shops, medium detail work	325 (30)
- welding shop	325 (30)
Mechanical/electrical equipment rooms	110 (10)
Parking areas	33 (3)
Toilets, wash, and dressing rooms	110 (10)
Visitor areas	215 (20)
Warehouses and storage rooms/areas	
- indoor stockroom, active/bulk storage	110 (10)
- indoor stockroom, inactive	55 (5)
- indoor rack storage	270 (25)
- outdoor storage	33 (3)
Work areas – general (not listed above)	325 (30)

**12.15 Site Sanitation Plan**

Hands and face will be thoroughly washed before eating, smoking, drinking, chewing gum or tobacco.

When possible, avoid contact with contaminated materials.

Support facilities such as wash facilities, eating areas, changing areas, and portable toilets will be located in the Support Zone. This area will remain "clean" and free of contamination.

An adequate supply of potable water will be provided to the employees working at the Site. Clearly labeled potable containers will be used to dispense drinking water. Containers will be cleaned at the beginning of each day. The containers will be equipped with taps to access the water. Clean disposable cups will be provided daily.

Portable and non-portable toilet facilities will be provided on-site for employees and will be located in the Support Zone. Non-portable toilets, showers, and designated eating areas are located in the trailer compound area.

Eating, drinking, smoking, chewing gum or tobacco, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited during remedial activities except in designated eating or smoking areas outside the Exclusion and Contaminant Reduction Zones. Severson employees, subcontractor employees, and service personnel are required to thoroughly decontaminate themselves prior to entering the Support Zone.

#### **12.16 Fire Prevention Plan**

There are several sources of work place fire hazards at the Site. These are: fuel storage areas, flammable material storage areas, dumpsters, equipment, and the LTTD facility.

The South Plainfield Fire Department will be the main means to extinguishing fires at the Site. Site personnel will be instructed on the proper use of the fire extinguishers provided at the Site as well as the expectations for their use.

The primary communication at the Site will be radios. In the event of a fire Site personnel will notify the SSHO or Site Superintendent of the fire, its location, size, and what material is involved. The SSHO or Site Superintendent will be the Emergency Coordinator until relieved by the South Plainfield Fire Department or Middlesex County HAZMAT Team. In the event radio communication is not available a portable air horn will be used to alert Site personnel an emergency situation is in progress. There will be 3 five-second blasts of the horn repeated twice with a 20-second break in between each set of 3 five-second blasts.

As part of the overall safety program, one of the most important means of fire prevention is housekeeping. Construction debris as well as trash will be disposed of or stored properly. Trash containers will be removed and emptied from the Site on a routine basis. Periodic inspections by the SSHO will identify any areas where housekeeping is not satisfactory and have it corrected by the Site Superintendent.

Site security is present at the Site during non-working hours and will alert the fire department in the event of a fire.

#### **13.0 Meeting the Requirements**

The Severson Corporate Health and Safety Plan will be maintained at the Site and will be used in conjunction with Activity Hazard Analysis, Safe Plans of Action, and Preparatory Meetings to ensure the provisions in the Accident Prevention Plan, EM 385-1-1, and 29 CFR 1926 are met.

#### **14.0 Site-Specific Hazards and Controls**

The following are the major definable features of work for the project. The Activity Hazard Analysis below provides the specific hazards and their controls for these definable features.

- Mobilization
- Excavation and screening of material
- LTDD Treatment
- Backfill and Hard Cap
- Decontamination

Mobilization			
ACTIVITY	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	
<ul style="list-style-type: none"> <li>▪ General site reconnaissance</li> <li>▪ Site preparation</li> <li>▪ Mobilize and inspect equipment</li> <li>▪ Placing or repairing perimeter fencing</li> <li>▪ Installation of office trailers and utilities and removal</li> <li>▪ Survey</li> <li>▪ Delivery of materials</li> <li>▪ Construction of LLTD soils stockpile and lay down areas</li> <li>▪ Establish monitoring locations</li> <li>▪ Decontamination and removal of equipment</li> </ul>	<b>Chemical/Toxicological Hazards:</b> <ol style="list-style-type: none"> <li>1. No exposure to contaminated material during mobilization.</li> <li>2. Exposure to chemicals brought onsite.</li> <li>3. Possible exposure to contaminated material during equipment decontamination.</li> </ol>	<b>Chemical/Toxicological Hazards:</b> <ol style="list-style-type: none"> <li>1. Hazard Communication Program.</li> <li>2. PPE (D) and Modified D (Decontamination)</li> <li>3. Results of air monitoring used to determine proper type of control program</li> </ol>	<b>RAC</b> <b>2<sup>1</sup></b>
	<b>Biological Hazards:</b> <ol style="list-style-type: none"> <li>1. Slight possibility of animals.</li> <li>2. Stinging and biting insects.</li> <li>3. Possible exposure to poison ivy, sumac, and/or oak.</li> </ol> <b>Physical Hazards:</b> <ol style="list-style-type: none"> <li>1. Moving equipment</li> <li>2. Falls from elevations</li> <li>3. Slips and trips</li> <li>4. Cold Stress/Heat Stress</li> <li>5. Noise exposure</li> <li>6. Caught between/struck by or against</li> <li>7. Severe weather</li> <li>8. Manual lifting</li> <li>9. Electrical</li> <li>10. Traffic</li> <li>11. Fueling operations</li> </ol>	<b>Biological Hazards:</b> <ol style="list-style-type: none"> <li>1. Avoid physical contact with animals. Do not threaten and/or corner animals. Make noise to get the animal to retreat. Stay in or return to vehicle or equipment.</li> </ol> <b>Physical Hazards</b> <ol style="list-style-type: none"> <li>1. Moving equipment               <ul style="list-style-type: none"> <li>▪ Only trained, experienced operators</li> <li>▪ Equipment inspected daily</li> <li>▪ Personnel restricted in area of operation</li> <li>▪ One set of signals given for movement of equipment</li> </ul> </li> <li>2. Falls from elevations               <ul style="list-style-type: none"> <li>▪ Maintain three points of contact when climbing on or off equipment</li> </ul> </li> <li>3. Slips and trips               <ul style="list-style-type: none"> <li>▪ Keep walking and working surfaces dry</li> <li>▪ Housekeeping - remove trip hazards</li> <li>▪ Alert employees to hazards of uneven terrain</li> </ul> </li> <li>4. Cold Stress/Heat Stress               <ul style="list-style-type: none"> <li>▪ Implement cold stress or heat stress controls</li> </ul> </li> <li>5. Noise exposure               <ul style="list-style-type: none"> <li>▪ Hearing control program which consists of audiometric examination, training, use of ear plugs, and sound level pressure monitoring</li> </ul> </li> <li>6. Caught between/struck by or against</li> </ol>	

<sup>1</sup> Based on the ESOH risk decision matrix on hazard probability (occasional) and hazard severity (marginal).

Mobilization		
ACTIVITY	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		<ul style="list-style-type: none"> <li>▪ Stay out of swing radius of equipment</li> <li>▪ Do not walk, work, or stand near equipment being loaded or unloaded</li> </ul> <p>7. Severe weather</p> <ul style="list-style-type: none"> <li>▪ As determined by Site Safety and Health Officer, operations are to cease during severe weather</li> </ul> <p>8. Manual lifting</p> <ul style="list-style-type: none"> <li>▪ Proper lifting technique utilized. Back straight and lift with legs.</li> <li>▪ Split heavy loads into smaller loads</li> <li>▪ Use mechanical aid, whenever possible</li> <li>▪ Make sure the path of travel is clear prior to the lift</li> </ul> <p>9. Electrical</p> <ul style="list-style-type: none"> <li>▪ Licensed electrician to perform installation</li> <li>▪ Installation in compliance with the Electrical Safety Act, and local codes</li> <li>▪ Equipment kept at least 10 feet from energized power lines &gt; 50 kv and 10 feet plus 0.4 inches for each kv above 50 kv</li> <li>▪ Portable equipment must have double insulation or ground fault circuit interrupter be used</li> </ul> <p>10. Traffic</p> <ul style="list-style-type: none"> <li>▪ Posted speed limit of 15 mph</li> <li>▪ Signage</li> </ul> <p>11. Fueling Operations</p> <ul style="list-style-type: none"> <li>▪ All equipment will be shut down prior to fueling.</li> <li>▪ All spilled fuel will be wiped up immediately.</li> <li>▪ No smoking in the area of fueling operations.</li> <li>▪ Fueling will be accomplished in well-ventilated areas away from ignition sources.</li> <li>▪ Equipment and fuel tank do not need to be bonded or grounded if the metal nozzle is in contact with the metal of the equipment's fuel tank.</li> </ul>

Mobilization		
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ol style="list-style-type: none"> <li>1. Pickup trucks</li> <li>2. Loader</li> <li>3. Hand tools</li> <li>4. Material delivery trucks</li> <li>5. Bulldozer</li> <li>6. Track Hoe</li> </ol>	<p>Site Inspection:</p> <ol style="list-style-type: none"> <li>1. Daily inspection by Site Safety and Health Officer</li> </ol> <p>Motor Vehicles:</p> <ol style="list-style-type: none"> <li>1. Before initial use vehicles will be inspected and found to be in a safe operating condition.</li> </ol> <p>Equipment:</p> <ol style="list-style-type: none"> <li>1. Before equipment is placed in use it will be inspected and tested by a competent person.</li> <li>2. Inspections and tests will be done in accordance with manufacturer's instructions.</li> <li>3. All equipment will be inspected daily when in use by the operator.</li> </ol>	<p>Site Specific:</p> <ol style="list-style-type: none"> <li>1. Site specific</li> <li>2. Daily tailgate</li> <li>3. Hazard Communication</li> <li>4. HAZWOPER</li> </ol> <p>Motor Vehicle:</p> <ol style="list-style-type: none"> <li>1. Operators shall hold a valid license for the type and class of vehicle they are operating.</li> </ol> <p>Heavy Equipment:</p> <ol style="list-style-type: none"> <li>1. Trained and qualified operators.</li> </ol> <p>Equipment General:</p> <ol style="list-style-type: none"> <li>1. Employees will be qualified and trained to operate or service mechanical equipment.</li> </ol>

Excavation of Contaminated Material			
PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	
<ul style="list-style-type: none"> <li>Utility mark out</li> <li>Lay area of excavation</li> <li>Excavate material</li> <li>Load material into trucks</li> <li>Soil sampling</li> <li>Transport material to lay down area</li> <li>Screen out large rocks and debris</li> <li>Stockpile for LLTD Treatment</li> <li>Cover stockpiles with poly cover</li> <li>Maintain erosion controls</li> </ul>	<b>Chemical/Toxicological Hazards:</b> <ol style="list-style-type: none"> <li>Possible contact with contaminated soils.</li> <li>Possible contact with vapors.</li> </ol>	<b>Chemical/Toxicological Hazards:</b> <ol style="list-style-type: none"> <li>Use of personal protective equipment.</li> <li>Personal decontamination prior to consumption of food, beverage, or tobacco.</li> <li>Results of air monitoring used to determine proper type of control program</li> </ol>	<b>RAC</b> <b>2<sup>2</sup></b>
	<b>Biological Hazards:</b> <ol style="list-style-type: none"> <li>Slight possibility of wild animals.</li> <li>Sting and biting insects.</li> </ol>	<b>Biological Hazards:</b> <ol style="list-style-type: none"> <li>Avoid physical contact with wild animals. Do not threaten and/or corner animals. Make noise to get the animal to retreat. Stay in or return to vehicle or equipment.</li> <li>Use appropriate insect repellants i.e., DEET.</li> </ol>	
	<b>Physical Hazards:</b> <ol style="list-style-type: none"> <li>Falls from elevations</li> <li>Slips and trips</li> <li>Heat/Cold stress</li> <li>Noise exposure</li> <li>Caught between/struck by or against</li> <li>Severe weather</li> <li>Manual lifting</li> <li>Manual Shoveling</li> <li>Fueling operations</li> <li>Traffic</li> <li>Electrical</li> </ol>	<b>Physical Hazards</b> <ol style="list-style-type: none"> <li>Falls from elevations <ul style="list-style-type: none"> <li>Maintain three points of contact when climbing on or off equipment</li> </ul> </li> <li>Slips and trips <ul style="list-style-type: none"> <li>Keep walking and working surfaces dry</li> <li>Housekeeping - remove trip hazards</li> <li>Alert employees to hazards of uneven terrain</li> </ul> </li> <li>Heat/Cold Stress <ul style="list-style-type: none"> <li>Refer to the Health and Safety Plan</li> </ul> </li> <li>Noise exposure <ul style="list-style-type: none"> <li>Hearing control program which consists of audiometric examination, training, and use of ear plugs</li> <li>Perform noise dosimetry monitoring during initial task startup to document noise levels for employees.</li> </ul> </li> <li>Caught between/struck by or against <ul style="list-style-type: none"> <li>Stay out of swing radius of equipment</li> <li>Ground personnel near operating heavy equipment will wear hard hats and traffic vests</li> </ul> </li> </ol>	

<sup>2</sup> Based on the ESOH risk decision matrix on hazard probability (occasional) and hazard severity (marginal).

Excavation of Contaminated Material		
PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		<ul style="list-style-type: none"> <li>Do not walk, work, or stand near equipment being loaded or unloaded</li> <li>Backup alarms to be in operable condition. No unnecessary backing.</li> <li>Steel toe footwear required</li> </ul> <p>6. Severe weather</p> <ul style="list-style-type: none"> <li>As determined by SSHO, operations are to cease during severe weather</li> </ul> <p>7. Manual lifting</p> <ul style="list-style-type: none"> <li>Proper lifting technique utilized. Back straight and lift with legs.</li> <li>Split heavy loads into smaller loads</li> <li>Use mechanical aid, whenever possible</li> <li>Make sure the path of travel is clear prior to the lift</li> </ul> <p>8. Manual shoveling</p> <ul style="list-style-type: none"> <li>Select the proper shovel for the task. A long handled, flat bladed shovel is recommended for shoveling loosened material.</li> <li>Inspect the handle for splinters and/or cracks; determine that the blade is securely attached to the handle.</li> <li>Use you legs and shoulders and not your back. Bend at the knees.</li> <li>Never be more than 15 inches from the material you are shoveling.</li> <li>If possible, throw the spoil behind you, rotating your body.</li> <li>Be alert for signs of stress such as pain, numbness, burning, and tingling.</li> </ul> <p>9. Fueling operations</p> <ul style="list-style-type: none"> <li>All equipment will be shut down prior to fueling.</li> <li>All spilled fuel will be wiped up immediately.</li> <li>No smoking in the area of fueling operations.</li> <li>Fueling will be accomplished in well-ventilated areas away from ignition sources.</li> <li>Equipment and fuel tank do not need to be bonded or grounded if the metal nozzle is in contact with the metal of the equipment's fuel tank.</li> </ul> <p>10. Traffic</p> <ul style="list-style-type: none"> <li>Speed limit of 5 miles per hour.</li> <li>Employees will wear traffic vests.</li> <li>Drivers to obey all safe driving regulations.</li> <li>Drives will not eat, smoke, or drink while operating motor vehicles on site</li> </ul> <p>11. Equipment kept at least 10 feet from energized power lines &gt; 50 kv</p>

Excavation of Contaminated Material		
PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		and 10 feet plus 0.4 inches for each kv above 50 kv.

Excavation of Contaminated Material		
EQUIPMENT TO BE USED	INSPECTION REQUIREMENT	TRAINING REQUIREMENTS
<ol style="list-style-type: none"> <li>1. Front End Loaders</li> <li>2. Track Excavators</li> <li>3. Backhoe</li> <li>4. Dump Trucks</li> <li>5. Hand tools</li> <li>6. Perimeter air monitoring</li> <li>7. Real time air monitoring</li> <li>8. Personal air monitoring</li> </ol>	<p>Site Inspection:</p> <ol style="list-style-type: none"> <li>1. Daily inspection by SSHO</li> </ol> <p>Motor Vehicles:</p> <ol style="list-style-type: none"> <li>1. Before initial use vehicles will be inspected by a mechanic and found to be in a safe operating condition.</li> </ol> <p>Equipment:</p> <ol style="list-style-type: none"> <li>1. Before equipment is placed in use it will be inspected and tested by a competent person.</li> <li>2. Inspections and tests will be done in accordance with manufacturer's instructions.</li> <li>3. All equipment will be inspected daily when in use by the operator.</li> <li>4. Inspections and tests will be documented and records will be maintained at the site.</li> <li>5. Sub-contractor equipment to be inspected by SSHO prior to use.</li> </ol>	<p>Site Specific:</p> <ol style="list-style-type: none"> <li>1. Initial site specific</li> <li>2. Daily tailgate safety meetings</li> <li>3. Hazard communication</li> <li>4. HAZWOPER</li> <li>5. Lead Awareness Training</li> <li>6. Safe Plan of Action</li> <li>7. Rigging (if applicable)</li> </ol> <p>Motor Vehicle:</p> <ol style="list-style-type: none"> <li>1. Operators shall hold a valid license for the type and class of vehicle they are operating.</li> </ol> <p>Heavy Equipment:</p> <ol style="list-style-type: none"> <li>1. Trained and qualified operators.</li> </ol> <p>Equipment General:</p> <ol style="list-style-type: none"> <li>1. Employees will be qualified and trained to operate or service mechanical equipment.</li> </ol>

Treatment of Soils			
PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	
<ul style="list-style-type: none"> <li>Screen soil material</li> <li>Load material into LTTD</li> <li>Stockpile treated material</li> </ul>	<b>Chemical/Toxicological Hazards:</b> <ol style="list-style-type: none"> <li>Possible contact with contaminated soils.</li> <li>Possible contact with vapors.</li> </ol>	<b>Chemical/Toxicological Hazards:</b> <ol style="list-style-type: none"> <li>Use of personal protective equipment.</li> <li>Personal decontamination prior to consumption of food, beverage, or tobacco.</li> </ol>	<b>RAC</b> <b>2<sup>3</sup></b>
	<b>Biological Hazards:</b> <ol style="list-style-type: none"> <li>Slight possibility of wild animals.</li> <li>Sting and biting insects.</li> </ol>	<b>Biological Hazards:</b> <ol style="list-style-type: none"> <li>Avoid physical contact with wild animals. Do not threaten and/or corner animals. Make noise to get the animal to retreat. Stay in or return to vehicle or equipment.</li> <li>Use appropriate insect repellants i.e., DEET.</li> </ol>	
	<b>Physical Hazards:</b> <ol style="list-style-type: none"> <li>Falls from elevations</li> <li>Slips and trips</li> <li>Heat/Cold stress</li> <li>Noise exposure</li> <li>Caught between/struck by or against</li> <li>Severe weather</li> <li>Manual lifting</li> <li>Manual Shoveling</li> <li>Fueling operations</li> <li>Traffic</li> <li>Fire or Explosion</li> <li>Electrocution</li> <li>Thermal</li> </ol>	<b>Physical Hazards</b> <ol style="list-style-type: none"> <li>Falls from elevations               <ul style="list-style-type: none"> <li>Maintain three points of contact when climbing on or off equipment</li> </ul> </li> <li>Slips and trips               <ul style="list-style-type: none"> <li>Keep walking and working surfaces dry</li> <li>Housekeeping - remove trip hazards</li> <li>Alert employees to hazards of uneven terrain</li> </ul> </li> <li>Heat/Cold Stress               <ul style="list-style-type: none"> <li>Refer to the Health and Safety Plan</li> </ul> </li> <li>Noise exposure               <ul style="list-style-type: none"> <li>Hearing control program which consists of audiometric examination, training, and use of ear plugs</li> </ul> </li> <li>Caught between/struck by or against               <ul style="list-style-type: none"> <li>Stay out of swing radius of equipment</li> <li>Ground personnel near operating heavy equipment will wear hard hats and traffic vests</li> <li>Do not walk, work, or stand near equipment being loaded or unloaded</li> <li>Backup alarms to be in operable condition. No unnecessary backing.</li> </ul> </li> </ol>	

<sup>3</sup> Based on the ESOH risk decision matrix on hazard probability (occasional) and hazard severity (marginal).

Treatment of Soils		
PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		<ul style="list-style-type: none"> <li>Steel toe footwear required</li> <li>Use lockout tagout controls on equipment during maintenance</li> <li>Turn off engine prior to exiting equipment</li> </ul> <p>6. Severe weather</p> <ul style="list-style-type: none"> <li>As determined by SSHO, operations are to cease during severe weather</li> </ul> <p>7. Manual lifting</p> <ul style="list-style-type: none"> <li>Proper lifting technique utilized. Back straight and lift with legs.</li> <li>Split heavy loads into smaller loads</li> <li>Use mechanical aid, whenever possible</li> <li>Make sure the path of travel is clear prior to the lift</li> </ul> <p>8. Manual shoveling</p> <ul style="list-style-type: none"> <li>Select the proper shovel for the task. A long handled, flat bladed shovel is recommended for shoveling loosened material.</li> <li>Inspect the handle for splinters and/or cracks; determine that the blade is securely attached to the handle.</li> <li>Use you legs and shoulders and not your back. Bend at the knees.</li> <li>Never be more than 15 inches from the material you are shoveling.</li> <li>If possible, throw the spoil behind you, rotating your body.</li> <li>Be alert for signs of stress such as pain, numbness, burning, and tingling.</li> </ul> <p>9. Fueling operations</p> <ul style="list-style-type: none"> <li>All equipment will be shut down prior to fueling.</li> <li>All spilled fuel will be wiped up immediately.</li> <li>No smoking in the area of fueling operations.</li> <li>Fueling will be accomplished in well ventilated areas away from ignition sources.</li> <li>Equipment and fuel tank do not need to be bonded or grounded if the metal nozzle is in contact with the metal of the equipment's fuel tank.</li> </ul> <p>10. Traffic</p> <ul style="list-style-type: none"> <li>Speed limit of 5 miles per hour.</li> <li>Employees will wear traffic vests.</li> <li>Drivers to obey all safe driving regulations.</li> </ul> <p>11. Fire or Explosion</p> <ul style="list-style-type: none"> <li>Follow Start Up Plan</li> <li>Provide a list of the proposed operating conditions for process parameters to be continuously monitored an recorded</li> <li>Provide and Operating Plan specifying detailed procedures for</li> </ul>

Treatment of Soils		
PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		<p>continued operation of the system. Based on the proof of performance results</p> <ul style="list-style-type: none"> <li>Provide a Demobilization Plan discussing how residual gases or materials will be handled.</li> </ul> <p>12. Electrocution</p> <ul style="list-style-type: none"> <li>Use controls, wiring, and equipment with adequate ground fault protection</li> <li>Perform all electrical work in accordance with applicable codes and under the supervision of a state licensed master electrician</li> <li>Never allow the use of ungrounded, temporary wiring during maintenance work on the unit, or grounded, temporary wiring in contact with water, wet, or damp surfaces that is not approved for those applications</li> </ul> <p>13. Thermal</p> <ul style="list-style-type: none"> <li>Perform manufacturer recommended shutdown and cool down procedures prior to working on, around, or entering the units</li> <li>Use penetrating temperature probes to measure that internal temperatures of soil or ash accumulations are ambient prior to entry into thermal treatment units for work</li> <li>Develop Confined Space Entry Procedures and means of rescue prior to performing entry</li> <li>Verify function, and use manufacture's temperature safety control systems.</li> <li>Post warning signs in high temperature or hot surface areas</li> <li>Use safety barriers to protect high temperature or hot surface areas</li> <li>Use heat resistant gloves and protective gear</li> <li>Do not allow maintenance by workers until unit has cooled to ambient temperatures</li> </ul>

Treatment of Soils		
EQUIPMENT TO BE USED	INSPECTION REQUIREMENT	TRAINING REQUIREMENTS
<ol style="list-style-type: none"> <li>1. Front End Loaders</li> <li>2. Power screen</li> <li>3. Hand tools</li> <li>4. Air monitoring</li> <li>5. Penetration thermometer</li> <li>6. Confined space entry supplies</li> </ol>	<p>Site Inspection:</p> <ol style="list-style-type: none"> <li>1. Daily inspection by SSHO</li> </ol> <p>Motor Vehicles:</p> <ol style="list-style-type: none"> <li>1. Before initial use vehicles will be inspected by a mechanic and found to be in a safe operating condition.</li> </ol> <p>Equipment:</p> <ol style="list-style-type: none"> <li>1. Before equipment is placed in use it will be inspected and tested by a competent person.</li> <li>2. Inspections and tests will be done in accordance with manufacturer's instructions.</li> <li>3. All equipment will be inspected daily when in use by the operator.</li> <li>4. Inspections and tests will be documented and records will be maintained at the site.</li> <li>5. Sub-contractor equipment to be inspected by SSHO prior to use.</li> </ol>	<p>Site Specific:</p> <ol style="list-style-type: none"> <li>1. Initial site specific</li> <li>2. Daily safety</li> <li>3. Hazard communication</li> <li>4. HAZWOPER</li> <li>5. Lockout Tagout</li> <li>6. LTID Operations</li> </ol> <p>Motor Vehicle:</p> <ol style="list-style-type: none"> <li>1. Operators shall hold a valid license for the type and class of vehicle they are operating.</li> </ol> <p>Heavy Equipment:</p> <ol style="list-style-type: none"> <li>1. Trained and qualified operators.</li> </ol> <p>Equipment General:</p> <ol style="list-style-type: none"> <li>1. Employees will be qualified and trained to operate or service mechanical equipment.</li> </ol>

Backfill and Hard Cap			
PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	
<ul style="list-style-type: none"> <li>Construct Sub-Grade               <ul style="list-style-type: none"> <li>Place fill</li> <li>Grade</li> <li>Survey</li> <li>Compaction</li> </ul> </li> <li>Paving operations               <ul style="list-style-type: none"> <li>Place hot pitch asphalt</li> <li>Compact asphalt</li> </ul> </li> </ul>	<b>Chemical/Toxicological Hazards:</b> <ol style="list-style-type: none"> <li>Possible contact with diesel fuel during fueling operations.</li> </ol>	<b>Chemical/Toxicological Hazards:</b> <ol style="list-style-type: none"> <li>Use of personal protective equipment.</li> <li>Personal decontamination prior to consumption of food, beverage, or tobacco.</li> </ol>	<b>RAC</b> <b>2<sup>4</sup></b>
	<b>Biological Hazards:</b> <ol style="list-style-type: none"> <li>Slight possibility of wild animals.</li> <li>Sting and biting insects.</li> </ol>	<b>Biological Hazards:</b> <ol style="list-style-type: none"> <li>Avoid physical contact with wild animals. Do not threaten and/or corner animals. Make noise to get the animal to retreat. Stay in or return to vehicle or equipment.</li> <li>Use appropriate insect repellants i.e., DEET.</li> </ol>	
	<b>Physical Hazards:</b> <ol style="list-style-type: none"> <li>Falls from elevations</li> <li>Slips and trips</li> <li>Heat/Cold stress</li> <li>Noise exposure</li> <li>Caught between/struck by or against</li> <li>Severe weather</li> <li>Manual lifting</li> <li>Manual Shoveling</li> <li>Fueling operations</li> <li>Traffic</li> <li>Contact with hot surfaces</li> </ol>	<b>Physical Hazards</b> <ol style="list-style-type: none"> <li>Falls from elevations               <ul style="list-style-type: none"> <li>Maintain three points of contact when climbing on or off equipment</li> </ul> </li> <li>Slips and trips               <ul style="list-style-type: none"> <li>Keep walking and working surfaces dry</li> <li>Housekeeping - remove trip hazards</li> <li>Alert employees to hazards of uneven terrain</li> </ul> </li> <li>Heat/Cold Stress               <ul style="list-style-type: none"> <li>Refer to the Health and Safety Plan</li> </ul> </li> <li>Noise exposure               <ul style="list-style-type: none"> <li>Hearing control program which consists of audiometric examination, training, and use of ear plugs</li> </ul> </li> <li>Caught between/struck by or against               <ul style="list-style-type: none"> <li>Stay out of swing radius of equipment</li> <li>Ground personnel near operating heavy equipment will wear hard hats and traffic vests</li> <li>Do not walk, work, or stand near equipment being loaded or unloaded</li> <li>Backup alarms to be in operable condition. No unnecessary backing.</li> </ul> </li> </ol>	

<sup>4</sup> Based on the ESOH risk decision matrix on hazard probability (occasional) and hazard severity (marginal).

Backfill and Hard Cap		
PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		<ul style="list-style-type: none"> <li>Steel toe footwear required</li> </ul> <p>6. Severe weather</p> <ul style="list-style-type: none"> <li>As determined by SSHO, operations are to cease during severe weather</li> </ul> <p>7. Manual lifting</p> <ul style="list-style-type: none"> <li>Proper lifting technique utilized. Back straight and lift with legs.</li> <li>Split heavy loads into smaller loads</li> <li>Use mechanical aid, whenever possible</li> <li>Make sure the path of travel is clear prior to the lift</li> </ul> <p>8. Manual shoveling</p> <ul style="list-style-type: none"> <li>Select the proper shovel for the task. A long handled, flat bladed shovel is recommended for shoveling loosened material.</li> <li>Inspect the handle for splinters and/or cracks; determine that the blade is securely attached to the handle.</li> <li>Use you legs and shoulders and not your back. Bend at the knees.</li> <li>Never be more than 15 inches from the material you are shoveling.</li> <li>If possible, throw the spoil behind you, rotating your body.</li> <li>Be alert for signs of stress such as pain, numbness, burning, and tingling.</li> </ul> <p>9. Fueling operations</p> <ul style="list-style-type: none"> <li>All equipment will be shut down prior to fueling.</li> <li>All spilled fuel will be wiped up immediately.</li> <li>No smoking in the area of fueling operations.</li> <li>Fueling will be accomplished in well ventilated areas away from ignition sources.</li> <li>Equipment and fuel tank do not need to be bonded or grounded if the metal nozzle is in contact with the metal of the equipment's fuel tank.</li> </ul> <p>10. Traffic</p> <ul style="list-style-type: none"> <li>Speed limit of 5 miles per hour.</li> <li>Employees will wear traffic vests.</li> <li>Drivers to obey all safe driving regulations.</li> </ul> <p>11. Contact with hot surfaces</p> <ul style="list-style-type: none"> <li>Asphalt material is extremely hot.</li> <li>Do not handle asphalt without hand protection.</li> <li>Personnel may NOT step on or off of paver unit while it is in motion.</li> <li>If seat belts are installed by the manufacturer for the paving unit they must be used while the paver is in motion.</li> </ul>

Backfill and Hard Cap		
PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		<ul style="list-style-type: none"> <li>• Avoid the use of water on or near the paving unit while personnel are on the equipment to prevent exposure to steam.</li> <li>• Do not stand between the paver and the material hopper while trucks are backing to paver.</li> <li>• Do not insert hands, arms, or tools into auger area while the equipment is energized.</li> </ul>

Backfill and Hard Cap		
EQUIPMENT TO BE USED	INSPECTION REQUIREMENT	TRAINING REQUIREMENTS
<ol style="list-style-type: none"> <li>1. Front End Loaders</li> <li>2. Track Excavators</li> <li>3. Backhoe</li> <li>4. Pickup Trucks</li> <li>5. Dump Trucks</li> <li>6. Bull Dozers</li> <li>7. Vibratory/Smooth Drum Roller</li> </ol>	<p>Site Inspection:</p> <ol style="list-style-type: none"> <li>1. Daily inspection by SSHO</li> </ol> <p>Motor Vehicles:</p> <ol style="list-style-type: none"> <li>1. Before initial use vehicles will be inspected by a mechanic and found to be in a safe operating condition.</li> </ol> <p>Equipment:</p> <ol style="list-style-type: none"> <li>1. Before equipment is placed in use it will be inspected and tested by a competent person.</li> <li>2. Inspections and tests will be done in accordance with manufacturer's instructions.</li> <li>3. All equipment will be inspected daily when in use by the operator.</li> <li>4. Inspections and tests will be documented and records will be maintained at the site.</li> <li>5. Sub-contractor equipment to be inspected by SSHO prior to use.</li> </ol>	<p>Site Specific:</p> <ol style="list-style-type: none"> <li>1. Initial site specific</li> <li>2. Daily safety meetings.</li> <li>3. Hazard communication</li> <li>4. HAZWOPER</li> </ol> <p>Motor Vehicle:</p> <ol style="list-style-type: none"> <li>1. Operators shall hold a valid license for the type and class of vehicle they are operating.</li> </ol> <p>Heavy Equipment:</p> <ol style="list-style-type: none"> <li>1. Trained and qualified operators.</li> </ol> <p>Equipment General:</p> <ol style="list-style-type: none"> <li>1. Employees will be qualified and trained to operate or service mechanical equipment.</li> </ol>

Decontamination			
ACTIVITY	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	
<ul style="list-style-type: none"> <li>Clean Equipment</li> <li>Remove Equipment</li> </ul>	<b>Chemical/Toxicological Hazards:</b> <ol style="list-style-type: none"> <li>Possible contact with contaminated soil.</li> <li>Possible exposure to fuels, lubricants, etc.</li> </ol>	<b>Chemical/Toxicological Hazards:</b> <ol style="list-style-type: none"> <li>Hazard Communication program.</li> <li>Modified Level D protection. Water resistant coveralls.</li> <li>MSDS's required for all chemicals on site.</li> <li>Air monitoring performed during decontamination activities as per the HASP.</li> </ol>	<b>RAC</b> <b>2<sup>5</sup></b>
	<b>Biological Hazards:</b> <ol style="list-style-type: none"> <li>Slight possibility of wild animals.</li> <li>Sting and biting insects.</li> </ol>	<b>Biological Hazards:</b> <ol style="list-style-type: none"> <li>Avoid physical contact with wild animals. Do not threaten and/or corner animals. Make noise to get the animal to retreat. Stay in or return to vehicle or equipment.</li> <li>Use appropriate insect repellants i.e., DEET.</li> </ol>	
	<b>Physical Hazards:</b> <ol style="list-style-type: none"> <li>Slips and trips</li> <li>Heat / Cold stress</li> <li>Noise exposure</li> <li>Caught between/struck by or against</li> <li>Severe weather</li> <li>Rotating parts</li> <li>Falls from elevations</li> <li>Manual lifting</li> <li>Manual shoveling</li> </ol>	<b>Physical Hazards</b> <ol style="list-style-type: none"> <li>Slips and trips               <ul style="list-style-type: none"> <li>Keep walking and working surfaces dry</li> <li>Housekeeping - remove trip hazards</li> <li>Alert employees to hazards of uneven terrain</li> </ul> </li> <li>Heat / Cold Stress               <ul style="list-style-type: none"> <li>Refer to the Health and Safety Plan.</li> </ul> </li> <li>Noise exposure               <ul style="list-style-type: none"> <li>Hearing control program which consists of audiometric examination, training, use of ear plugs, and sound level pressure monitoring</li> </ul> </li> <li>Caught between/struck by or against               <ul style="list-style-type: none"> <li>Stay out of swing radius of equipment</li> <li>Ground personnel near operating heavy equipment will wear hard hats and traffic vests</li> <li>Do not walk, work, or stand near equipment being loaded or unloaded</li> <li>Backup alarms to be in operable condition. No unnecessary backing.</li> </ul> </li> </ol>	

<sup>5</sup> Based on the ESOH risk decision matrix on hazard probability (occasional) and hazard severity (marginal).

Decontamination		
ACTIVITY	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		<ul style="list-style-type: none"> <li>Steel toe footwear required</li> <li>Turn off engine prior to exiting equipment</li> </ul> 5. Severe weather <ul style="list-style-type: none"> <li>As determined SSHO, operations are to cease during severe weather</li> </ul> 6. Rotating parts <ul style="list-style-type: none"> <li>Employees kept out of area of rotating equipment</li> <li>No loose clothing permitted</li> </ul> 7. Falls from elevation <ul style="list-style-type: none"> <li>Maintain three points of contact when climbing on or off equipment</li> <li>Fall protection program when working from heights greater than 6 feet.</li> </ul> 8. Manual lifting <ul style="list-style-type: none"> <li>Proper lifting technique utilized. Back straight and lift with legs.</li> <li>Split heavy loads into smaller loads</li> <li>Use mechanical aid, whenever possible</li> <li>Make sure the path of travel is clear prior to the lift</li> </ul> 9. Manual Shoveling <ul style="list-style-type: none"> <li>Select the proper shovel for the task</li> <li>Use your legs and shoulders and not the back.</li> <li>Be alert for signs of stress such as pain, numbness, burning, and tingling.</li> </ul>

Decontamination		
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ol style="list-style-type: none"> <li>1. Various Heavy Equipment</li> <li>2. Water Source</li> <li>3. Pressure Washer (&lt;3500 psi)</li> </ol>	<p>Site Inspection:</p> <ol style="list-style-type: none"> <li>1. Daily inspection by SSHO</li> </ol> <p>Equipment:</p> <ol style="list-style-type: none"> <li>1. Before equipment is placed in use it will be inspected and tested by a competent person.</li> <li>2. Inspections and tests will be done in accordance with manufacturer's instructions.</li> <li>3. All equipment will be inspected daily when in use by the operator.</li> <li>4. Inspections and tests will be documented and records will be maintained at the site. Monthly written inspection for each crane.</li> </ol>	<p>Site Specific:</p> <ol style="list-style-type: none"> <li>1. OSHA HAZWOPER</li> <li>2. Initial site specific</li> <li>3. HTRW training.</li> <li>4. Daily tailgate safety meetings</li> <li>5. Hazard communication</li> </ol> <p>Supervisory Personnel:</p> <ol style="list-style-type: none"> <li>1. OSHA Supervisor's training</li> </ol> <p>Heavy Equipment:</p> <ol style="list-style-type: none"> <li>1. Trained and qualified operators.</li> </ol> <p>Equipment General:</p> <ol style="list-style-type: none"> <li>1. Employees will be qualified and trained to operate or service mechanical equipment.</li> </ol>

## *Appendix A*

### *Summary of Training and Work Experience for Safety Personnel*

Name:	<b>PAUL J. HITCHO, PhD, CIH</b>
Education:	PhD, Biology, University of Notre Dame, 1970 BA, Biology, St. Vincent College, 1966
Certifications and Honors:	Board-Certified Industrial Hygienist, American Board of Industrial Hygiene National Science Foundation, Predoctoral Trainee, University of Notre Dame National Institutes of Health Postdoctoral Fellow, University of Massachusetts Certificate of Appreciation, US Department of Labor
Position:	<b>Vice President, Director of Health and Safety</b>

**Dr. Hitcho** brings a rich professional background to Severson Environmental Services, Inc. He has conducted extensive research as a postdoctoral Fellow at the University of Massachusetts and taught at the university level. He was a field industrial hygienist for the Occupational Safety and Health Administration for 3 years, and later served as supervisor of industrial hygiene for the Pittsburgh Area Office. While serving as the head of the Industrial Hygiene Department for the United Steelworkers of America, Dr. Hitcho acted as liaison between the union and the coal carbonization (coking) industry and related chemical industries. He is recognized as a world authority in this field by the International Agency for Research on Cancer (IARC). The IARC monographs developed while he was an active participant are cited by OSHA today in that agency's hazardous communications standard 29 CFR 1910.120. Dr. Hitcho also interfaced with pesticide and herbicide manufacturers to conduct occupational health studies and to develop hazard analyses for some of the processes in this industry. Since 1986, Dr. Hitcho has served as the Director of Occupational Health and Safety for Severson. On every project the firm has undertaken since then, he has developed, implemented, reviewed, and evaluated the project-specific worker health and safety plans, as well as overseeing the medical monitoring of all field employees. Dr. Hitcho supervises a staff of 42 Site Health and Safety Officers. He has overseen the health and safety aspects of all Severson's projects

## **PROFESSIONAL EXPERIENCE**

- Teaching Assistant: University of Notre Dame – 1966-1968
- National Science Foundation Trainee: University of Notre Dame – 1968 – 1970
- Post Doctoral Research Fellow: University of Notre Dame – 1970 – 1971
- National Institute of Health Post Doctoral Fellow: University of Massachusetts, Amherst, MA – 1971 – 1974
- Field and Supervisory Industrial Hygienist, OSHA, Pittsburgh Sun Office – 1974 – 1979
- Technician and Assistant Department Head – Health and Safety: United Steelworkers of America – 1979 – 1986
- Director of Occupational Health and Safety and Vice President: Severson Environmental Services, Inc., Niagara Falls, NY: 1986 to Present

<b>Name:</b>	<b>ERIC TSCHUDI</b>
<b>Certifications:</b>	40 Hour OSHA HAZWOPER Training 8 Hour OSHA HAZWOPER Supervisor Training 8 Hour OSHA HAZWOPER Refresher Training 10 Hour OSHA Construction Safety Course USACE Contractors Quality Management Course USEPA Region IV Oversight Training First Aid / CPR Certification Confined Space Entry
<b>Project Assignment:</b>	<b>Site Health and Safety Officer</b>

## **PROFESSIONAL EXPERIENCE**

**Mr. Tschudi**, is a Site Health and Safety Officer with Severson Environmental Services, Inc. and has nineteen years of experience in working with hazardous materials. Mr. Tschudi started his career in the commercial nuclear power industry where he was responsible for worker safety while working with or around radiation and has since become responsible for the safety and health of workers at our sites. Mr. Tschudi is responsible for implementing the site specific health and safety plan; on site training for respirator protection, confined space entries, fall protection program, hazardous communication program, exposure control program; performed real time air monitoring for workers and community. Mr. Tschudi's has gained significant experience in occupational safety and industrial hygiene while being assigned to Superfund projects administered by the USACE. Mr. Tschudi was the SSHO assigned to the Federal Creosote Superfund Site where he was responsible for health and safety for over 560,000 safe man-hours worked over a seven-year period with no lost time accidents.

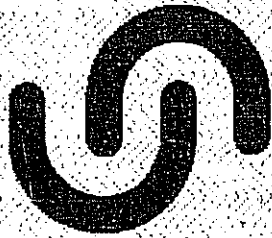
- **Welsbach General Gas Mantle Superfund Site, Gloucester City, NJ:** Site Safety and Health Officer  
Excavation, staging, and transportation of soils contaminated with thorium and radium.
- **Cornell Dubilier Electronics Superfund Site, South Plainfield, NJ:** Site Safety and Health Officer.  
Demolition of existing site structures with asbestos and lead contamination and excavation of soils contaminated with PCB, pesticides, polycyclic aromatic hydrocarbons, and metals. The occupational and community air monitoring performed for this project was; real time dust and VOC monitoring, TO-4a (PAH) sampling, NIOSH 7300 (Lead), 7400 (Asbestos) and 5503 (PCB), and OSHA 65 (Benzidine) sampling.
- **Federal Creosote Superfund Site, Manville, NJ:** Site Safety and Health Officer.

Creosote contaminated soil excavation, disposal, and restoration in a residential and light industrial setting. The occupational and community air monitoring performed for this project was; real time dust and VOC monitoring, EPA PM-10 sampling, TO-13 (VOC) and TO-14 (SVOC) sampling, NIOSH 1501 (PAH) and 5506 (BTEX) sampling.

- **Montclair Superfund Site, Montclair, NJ:** Site Safety and Health Officer  
Radioactive soil excavation and building decontamination and rehabilitation in a neighborhood setting. Responsible for implementing the site specific health and safety plan; performed on site training for respiratory protection program, confined space entries, fall protection program, hazardous communication program; performed real time air monitoring as well as NIOSH 0500 sampling; prepared Activity Hazard Analysis; and performed site audits.
- **U.S. Radium Superfund Project, Orange, NJ:** Health Physics Technician.  
Radioactive soil excavation and building decontamination and rehabilitation in a residential neighborhood setting. Level C protection worn.
- **Montclair Superfund Site, Montclair, NJ:** Health Physics Technician.  
Radioactive soil excavation and building decontamination and rehabilitation in a residential neighborhood setting. Level C protection.

Past Experience:

1993 - 1998	CDM Federal Programs Corporation, Atlanta, GA Environmental Technician
1989 - 1991	NUS Corporation, Tucker, GA Field Technician
1989 - 1993	Bartlett Nuclear, Inc., Plymouth, MA Radiation Technician



# Certificate of Training

*This Certifies That*

Eric Tschudi

name

*has successfully completed the Supervising 8 hour course in*

HAZARDOUS WASTE OPERATIONS

*prepared and conducted by*

**Sevenson Environmental Services, Inc.**

February 11, 2000

date of award

*Paul J. Hitcho*  
Paul J. Hitcho, Ph.D., CIH

Director of Occupational Health and Safety

S.S. # \_\_\_\_\_

# TRAINING CERTIFICATE

presented to

**Eric Tschudi**

This document certifies that the above named individual has attended a seminar entitled

**OSHA COMPETENT PERSON  
OSHA EXCAVATION RULE, SUBPART P  
29 CFR 1926**

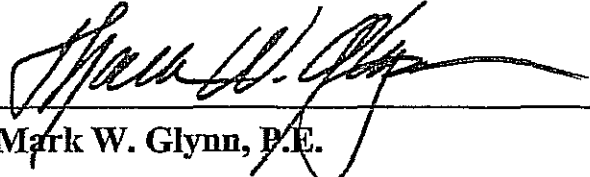
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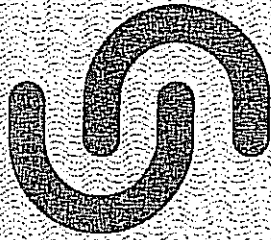
Glynn Geotechnical Engineering  
415 S. Transit Street  
Lockport, New York 14094  
716.625.6933



Presented on:  
**December 18, 2004**

**INSTRUCTOR**

  
Mark W. Glynn, P.E.



## *Certificate of Training*

*This Certificate That*

*Eric Tschudi*

*name*

*has successfully completed the 8 hour refresher course in*

*HAZARDOUS WASTE OPERATIONS*

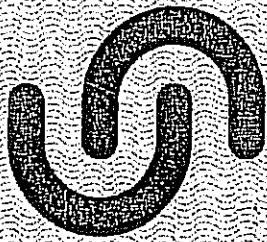
*prepared and conducted by*

**Sevenson Environmental Services, Inc.**

*December 12, 2008*

*date of award*

*Paul H. Hiteh*  
*Trainer*



## *Certificate of Training*

*This Certifies That*

Eric Tscuhdi

*name*

*has successfully completed the 8 hour refresher course in*

*HAZARDOUS WASTE OPERATIONS*

*prepared and conducted by*

**Sevenson Environmental Services, Inc.**

December 7, 2007

*day of award*

*Paul Litch*

*Trainer*



## WORK STATUS REPORT

Employer Copy

TYPE OF EXAMINATION: Periodic Examination

EMPLOYEE: Tschudi, Eric  
SSN: XXX-XX-4939  
DATE OF EXAM: 09/05/2008  
EXPIRATION DATE: 09/05/2009

COMPANY: Severson Environ. Services  
POSITION: Health and Safety Officer  
LOCATION: Severson Environmental Services, Inc.  
SITE: Manville

The following recommendations are based on a review of one or all of the following: a base history questionnaire, supporting diagnostic tests, physical examination, and the essential functions of the position applied for or occupied by the individual named above.

The following recommendations includes review of the following exam components:

- Blood Lead/ZPP

	Yes	No	Undecided
Has the employee any detected medical conditions that would increase his/her risk of material health impairment from occupational exposure in accordance with 29 CFR §1910.120?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Does the employee have any limitations in the use of respirators in accordance with 29 CFR §1910.134?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### STATUS

1. ☒ **QUALIFIED** The examination indicates no significant medical condition. Employee can be assigned any work consistent with skills and training.
2. ☐ **QUALIFIED - WITH LIMITATIONS** The examination indicates that a medical condition currently exists that limits work assignments on the following basis:
3. ☐ **NOT QUALIFIED**
4. ☐ **DEFERRED** The examination indicated that additional information is necessary. The employee has been given the following instructions.

### COMMENTS:

*Negative Drug Screen.*

I have reviewed the medical data of the above named employee, and informed the employee of the results of the medical examination and any medical conditions that require follow-up examination or treatment.

Name of Physician: Peter P. Greaney, M.D.

Date: 09/11/08

Signature: Peter P. Greaney MD



## Certificate of Course Completion

Eric M TSCHUDI

Student's Name

OSHA - 10 Hour Construction Industry Outreach Training Program

Course Title

09/16/2008 13:40 CST

Course Completion Date

  
Student's Signature

1018733

Certificate Number

10

# of hours approved

I hereby attest that I have completed the above named safety course in accordance with the ethical guidelines defined by, **Nukeworker**. I acknowledge that I consumed all information and took all Pertinent quizzes and/or final tests.

**Nukeworker**  
7809 Blueberry Road.  
Powell, TN, 37849.  
Tel: 865.938.6884

## *Appendix B*

### *Site Specific Health and Safety Plan*

**Cornell-Dubilier Electronics Superfund Site  
Operable Unit 02 – Soil Remediation**

**South Plainfield, New Jersey**

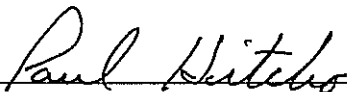
Contract Number – W912DQ-04-D-0023 TO-0011

**Accident Prevention Plan**

**Appendix B**

**Site Safety and Health Plan**

March 6, 2009



---

Paul Hitcho Ph.D., CIH, Safety and Health Manager  
Sevenson Environmental Services, Inc.

3-25-09  
Date

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## Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists'
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
APP	Accident Prevention Plan
CBC	Complete Blood Count
CFR	Code of Federal Regulation
CIH	Certified Industrial Hygienist
cm	Centimeter
CO	Carbon Monoxide
CPR	Cardiopulmonary resuscitation
CY	Cubic yard
DOT MUTCD	Department of Transportation Manual on Uniform Traffic Control Devices
EM	Engineering Manual
EMS	Emergency Medical Service
FEV1	Forced Expiratory Volume in 1 second
FVC	Forced Vital Capacity
GFCI	Ground Fault Circuit Interrupter
HAZWOPER	Hazardous Waste Operations and Emergency Response
HTRW	Hazardous, Toxic and Radioactive Wastes
IDLH	Immediately Dangerous to Life and Health
LEL	Lower Explosive Limit
LTTD	Low Temperature Thermal Desorption
m	Meter
mg/m <sup>3</sup>	milligram per cubic meter
MSDS	Material Safety Data Sheets
NIOSH	National Institute for Occupational Safety and Health
NJDEP	New Jersey Department of Environmental Protection
OSHA	Occupational Safety and Health Administration
O <sub>2</sub>	Oxygen gas
OU-2	Operating Unit 2
PCB	Polychlorinated biphenyls
PEL	Permissible Exposure Limit
PID	Photo Ionization Detector
PPE	Personal Protective Equipment
ppm	parts per million
PRAC	Pre-placed Remedial Action Contract
ROPS	Roll Over Protective Structure
SHM	Safety and Health Manager
SMAC 24	Blood tests that gives your doctor important information about the current status of your kidneys, liver, and electrolyte and acid/base balance as well as of your blood sugar and blood proteins.
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
TBD	To Be Determined

TWA	Time Weighted Average
ug/m <sup>3</sup>	microgram per cubic meter
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds

## 1.0 INTRODUCTION

Sevenson Environmental Services, Inc., is under contract to the US Army Corps of Engineers (USACE), Kansas City District Pre-Placed Remedial Contract (PRAC), to perform remedial action at the Cornell-Dubilier Electronics Superfund Site, South Plainfield, New Jersey.

The remedial action effort will focus on the remediation of the Cornell-Dubilier Electronics Superfund Site, Operable Unit 02 (OU-2), in the Borough of South Plainfield, Middlesex County, New Jersey. OU-2 consists of contaminated facility site soils. Work includes excavation of 107,000 cubic yards (CY) of contaminated soils and subsurface debris; onsite treatment of excavated soils amenable to treatment by low temperature thermal desorption (LTTD) followed by backfilling of excavated areas with treated soils; transportation of contaminated soil and debris not suitable for onsite LTTD treatment to an offsite facility for disposal; installation of a multi-layer cap or hardscape; installation of engineering controls; restoration; sampling and analysis of soil, water air, and building material; and other activities necessary for complete and proper remediation of the site.

### 1.1 Plan Objective

The objective of this Site Safety and Health Plan (SSHP) is to define the requirements and designate protocols to be followed during remedial action at the Cornell-Dubilier Project. Applicability extends to Sevenson personnel, Sevenson's subcontractors, and visitors inclusive of USACE personnel and representatives, engineers, and subcontractors. Work performed under this contract will comply with applicable Federal, State, and Local Safety and Occupational Health laws and regulations. Through careful planning and implementation of corporate and site-specific safety protocols, Sevenson will strive for zero accidents and incidents on the project.

### 1.2 References

During development of this SSHP, consideration was given to current safety and health standards as defined by the USACE, United States Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), and the National Institute for Occupational Safety and Health (NIOSH). Specifically, the following reference sources have been utilized in the development of this SSHP:

- OSHA Regulations: 29 CFR 1910 and 1926;
- USEPA Standard Operating Safety Guides, June 1992;
- NIOSH/OSHA/Coast Guard (USCG)/USEPA "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities";
- NIOSH Pocket Guide to Chemical Hazards, September 2005;
- American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for Chemical Substances and Chemical Agents, 2007;
- Hazardous Waste Handbook for Health & Safety, Martin, Lippitti, Prothero, 1987;
- Handbook of Toxic and Hazardous Chemicals and Carcinogens, Sittig, 1985;

- USACE, Safety and Health Requirements, EM 385-1-1, 3 November 2003 and September 2008;
- USACE, Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities, ER 385-1-1, 01 July 2003;
- Project Specifications for Operable Unit 2- Soils Remediation Cornell-Dubilier Electronics Superfund Site, Malcolm Pirnie, Inc., June 2008.
- Design Analysis Report, Cornell-Dubilier Electronics Superfund Site, Operable Unit 2, South Plainfield, New Jersey, USACE Kansas City District, June 2008.

In addition to the above-referenced documents, Severson has established a comprehensive and realistic Safety, Health, and Environmental Program based on past experience, sound engineering practice, employee training, and enforcement of Safety and Health regulations to prevent unreasonable Safety and Health risks. For specific procedures/programs associated with this project, refer to the Severson Corporate Health and Safety Plan. A copy of the Severson Corporate Health and Safety Plan will be maintained on site.

### **1.3 Site Safety and Health Plan Revisions**

The development and preparation of this SSHP has been based on site-specific information provided to Severson. Should any unforeseen hazard become evident during the performance of the work, the SSHO will bring such hazard to the attention of the Contracting Officer Representative both verbally and in writing for resolution as soon as possible. In the interim, Severson will take necessary actions to maintain safe working conditions in order to safeguard on-site personnel, visitors, the public, and the environment. Modifications of any portion or provision of the SSHP will be requested in writing from the Contracting Officer by the SSHO, and authorized in writing. No changes to the SSHP will be allowed until the item has been reviewed and an addendum prepared and approved by Safety and Health Manager.

During the course of the project the requirements from EM 385-1-1 September 2008 (not yet officially released at this time) will be incorporated as necessary into the safety program.

### **1.4 Site Information**

The Cornell-Dubilier Electronics Superfund Site (the Site) is located at 333 Hamilton Boulevard in the Borough of South Plainfield, Middlesex County, New Jersey. The Site consists of approximately 22 acres including the Hamilton Industrial Park, contaminated portions of the Bound Brook adjacent to and downstream of the industrial park, and contaminated residential, municipal, and commercial properties in the vicinity of the former Cornell-Dubilier Electronics Corporation, Inc. facility. The Site is bounded by the Lehigh Valley Railroad to the northeast, Factory Street to the southeast, Spicer Avenue to the southwest, and by Hamilton Boulevard. The area is a busy, heavily developed mixed-use neighborhood.

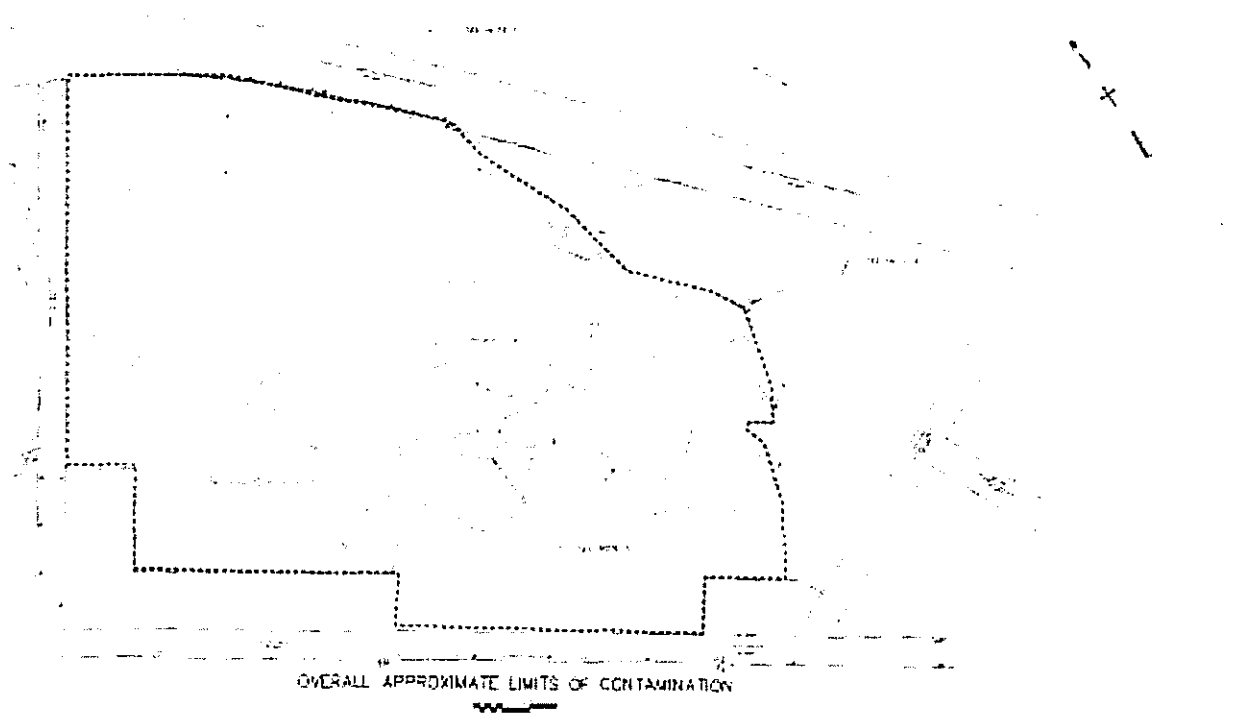
The developed portion of the facility (the northwestern portion) comprises approximately 45 percent of the total land area and contains buildings, a system of catch basins to channel storm water flow, and paved roadways. Several of the catch basins drain into a storm water collection system whose outfalls discharge at various locations along Bound Brook. The other 55 percent of the property is predominately vegetated. The central part of the undeveloped portion is primarily an open field, with

some wooded areas to the northeast and south, and a deteriorated, partially paved area in the middle. The northeast and southeast boundaries consist primarily of wetland area adjacent to Bound Brook, which flows from the eastern corner across the northeastern border of the undeveloped portion of the facility.

Cornell-Dubilier Electronics operated what is now Hamilton Industrial Park from 1936 to 1962, manufacturing electronic components including capacitors. Polychlorinated biphenyls (PCBs) and chlorinated organic degreasing solvents were used in the manufacturing process. Based on historic site practices, portions of the Site have the potential to be contaminated with lead, mercury, PCBs, Trichloroethylene, dechlorination products, and other contaminants of concern.

The area of concern has an estimated 107,000 CY of PCB contaminated soil and buried debris. Refer to *Figure 1 - "Remediation Area"*.

Figure 1 – Remediation Area



### 1.5 Chemicals of Concern

Data provided in *Appendix D, Table 1, of the Design Analysis Report Operable Unit 2- Soils Remediation, June 2008*, identifies the maximum soil concentrations. The data from this table was used to determine the exposure limits set in this document.

The predominant contaminants detected were metals, some volatile organic compounds (VOCs), and polychlorinated biphenyls (PCBs). Based on the data and potential to become a health hazard, five contaminants of concern were determined – lead, PCBs, benzene, trichloroethylene (TCE), and vinyl chloride. Chemical Information Sheets for these five of the contaminants of concern can be found in *Appendix C- Chemical Information Sheets*.

A PCB Protection Plan and Perimeter Air Monitoring Plan has been developed under separate cover to supplement sections of this plan. The contents of these plans should be consistent with this plan. However, in the event of a discrepancy the PCB Protection Plan and Perimeter Air Monitoring Plan will take precedence until the discrepancy is resolved by the SHM and approved by the Contracting Officer's Representative.

Operational chemicals may be brought to the project-site for use in activities supporting the remedial activities. These chemicals are used for fuels in operating heavy equipment and the LTTD, glues for welding pipes, painting, etc. The use of operational chemicals is regulated by OSHA under the Hazard Communication Standard (29 CFR 1910.1200). Material Safety Data Sheets (MSDSs) for operational chemicals are kept on file in the project office trailer. An inventory list of the anticipated operational chemicals (Hazardous Chemical Inventory List) for use at the Cornell-Dubilier site will be maintained at the site and updated as new material is received.

Each hazardous material must receive approval from the COR prior to being brought onsite or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of hazardous materials.

## **2.0 ORGANIZATION AND RESPONSIBILITIES**

While the Severson Safety and Health Department directs and supervises the overall Safety, Health and Environmental Program, the responsibility for Safety and Health extends throughout our organization from top management to every employee. For this reason, it is each person's duty to notify the management personnel if a hazardous condition is identified and to make a "stop work" call when the condition represents an immediate danger to life or health, until the SSHO can make a further determination. The following are the Severson project personnel positions and responsibilities for this project. Refer to *Figure 2 – "Organizational Chart"*.

- **Corporate Project Manager:** Alfred LaGreca
- **Project Manager:** Kim Lickfield
- **Project Superintendent:** Perry Novak
- **Safety and Health Manager:** Paul Hitcho, Ph.D., CIH
- **Occupational Physician:** Dr. Peter Greaney
- **Site Safety and Health Officer:** Eric Tschudi
- **Alternate SSHO:** TBD
- **First Aid/CPR Qualified Personnel:** Eric Tschudi, TBD

- **Subcontractors:** TBD

## **2.1 Corporate Project Manager**

The Corporate Project Manager directs and manages all aspects of the project in compliance with all contract and technical requirements. The Corporate Project Manager will monitor and control all subcontractors to achieve optimal performance and ensure safe, high quality performance that complies with all contract requirements.

## **2.2 Project Manager**

The Project Manager reports to the Corporate Project Manager. His responsibilities include coordinating project activities with the Project Superintendent and serving as the primary liaison with the Contracting Officer Representative. The Project Manager prepares all correspondence, submittals, and other documentation required for the project; coordinates schedules; and administers the contract. The Project Manager prepares reports and documentation, supervises inspection personnel, and reviews and approves procurement and subcontract activities.

## **2.3 Project Superintendent**

The Project Superintendent supervises and coordinates all construction crew activities relating to site preparation, excavation, shipping, and restoration. The Project Superintendent has the operational responsibility for the implementation of the SSHP on this project. This includes establishing an attitude of concern for safety matters by initiating prompt corrective action of hazards brought to his attention, and ensuring that the project safety and health requirements are initiated and observed by all project personnel. The Project Superintendent is the Competent Person for the operations at the site.

The Superintendent plans and requires that all work be performed in compliance with this SSHP, the Severson Corporate Health and Safety Plan and/or the client's safety program including all applicable local, state, and federal regulations. He will impress upon all subcontractors' supervisory personnel a sense of responsibility and accountability of each individual to maintain a safe workplace and to work in a safe manner.

## **2.4 Safety and Health Manager (SHM)**

Responsible to the Corporate Officer in charge, Paul Hitcho Ph.D., CIH, the Safety and Health Manager formulates, administers and coordinates programs for the company to reduce the risk of loss due to employee injury, regulatory non-compliance, general liability, fire, theft, or damage. The Safety and Health Manager will develop written detailed policies and procedures covering elements in the Safety, Health and Environmental Program. The Safety and Health Manager's work history/resume and certifications are in Appendix A. The Safety and Health Manager will:

- Be responsible for the development, implementation, oversight, and enforcement of the SSHP.
- Sign and date the SSHP prior to submittal
- Conduct initial site-specific training.
- Be present onsite during the first day of remedial activities and at the startup of each new major phase.

- Visit the site as needed and at least once per field event to audit the effectiveness of the SSHP and be available for emergencies.
- Provide onsite consultation as needed to ensure that the SSHP is fully implemented.
- Coordinate any modifications to the SSHP with the Site Superintendent, the SSHO, and the Contracting Officer's Representative.
- Provide continued support for upgrading/downgrading the level of personal protection.
- Be responsible for evaluating air monitoring/sampling data and recommending changes to engineering controls, work practices, and Personal Protective Equipment (PPE).
- Review accident reports and results of daily inspections.
- Serve as a member of the Severson's quality control staff.
- Conduct quarterly Site inspection and report findings to USACE during the period of work activities onsite.

## **2.5 Certified Industrial Hygienist (CIH)**

The Certified Industrial Hygienist for this project will be the Safety and Health Manager. The CIH will assist in the development, implementation, and enforcement of the SSHP, provide consultation, review air monitoring data; and assist in safety audits and document review. Visit the site as needed and at least once per quarter for the duration of activities.

## **2.6 Occupational Physician**

Under the direction of the Safety and Health Manager, the Occupational Physician will be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1910.120(f), and 1926.53(f). The Occupational Physician will provide the Safety and Health Manager with a written opinion of each employee's ability to perform hazardous remedial work.

## **2.7 Site Safety and Health Officer (SSHO)**

The SSHO for this project is Mr. Eric Tschudi, his work history/resume and certifications are in Appendix A. Under the direction of the Safety and Health Manager, the SSHO will be responsible for the implementation of this SSHP and for the daily coordination of safety activities with the Project Superintendent and the Contracting Officer Representative to ensure that the planned work objectives reflect adequate safety and health considerations. The SSHO will submit to the Contracting Officer Representative Certificates of Worker/Visitor Acknowledgements for site personnel prior to initial entry onto the site. He will maintain a complete copy of this plan (and its supplements and addenda) at the site during all field activities and assure that all workers and visitors are familiar with it. He will perform site-specific training and briefing sessions for employee(s) prior to the start of field activities at the site and a briefing session each day before starting work. He will ensure the availability, proper use and maintenance of specified personal protective equipment, decontamination equipment, and

other safety and health equipment. He will maintain a high level of safety awareness among team members and communicate pertinent matters to them promptly. The SSHO will:

- Assist and represent the Safety and Health Manager in on-site training and the day-to-day on-site implementation and enforcement of the accepted SSHP.
- Be assigned to the site on a full time basis for the duration of field activities excluding site grading, filling, paving, site restoration, and demobilization. The SSHO shall be at the site on a part-time basis during these activities. The SSHO may have other duties besides safety and health related duties, but health and safety duties shall come first. If operations are performed during more than one shift per day, an SSHO shall be present for each shift.
- Have the authority to ensure site compliance with specified safety and health requirements, Federal, state and OSHA regulations; and all aspects of the SSHP. This includes, but is not limited to, activity hazard analyses, air monitoring/sampling, use of PPE, decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls; the emergency response plan, confined space entry procedures, spill containment program, and preparation of records. This will be accomplished by performing a daily safety and health inspection and documenting results on the Daily Safety Log.
- Have authority to stop work activities if unacceptable health or safety conditions exist, and take necessary action to re-establish and maintain safe working conditions.
- Consult and coordinate any modifications to the SSHP with the Safety and Health Manager, the Site Superintendent, and the Contracting Officer's Representative.
- Serve as a member of the Severson's quality control staff on matters relating to safety and health. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.
- Conduct accident investigations and prepare accident reports. ENG Form 3394 USACE Accident Investigation form will be filled out and submitted to USACE Safety Officer for pen and ink changes, and final submitted within 5 working days.
- Review results of daily quality control inspections and document safety and health findings in the Daily Safety Log. Prepare and submit Weekly Safety Reports.
- Coordinate with Site Management and the Safety and Health Manager, recommend corrective actions for identified deficiencies, and oversee the corrective actions.
- Maintain a deficiency tracking log per EM 385-1-1, paragraph 01.A.12(d), on a health and safety bulletin board as specified in EM 385-1-1, paragraph 01.A.06.
- Maintain applicable safety reference material on the job site.
- Participate in initial pre-entry briefing and conduct periodic safety briefings.

## **2.8 Alternate Site Safety and Health Officer**

An alternate Site Safety and Health Officer will be appointed for Mr. Tschudi. The alternate will assume all responsibilities of the SSHO in the event of his absence.

## **2.9 Safety and Health Technicians**

For each work crew in the exclusion zone, one person designated as a Safety and Health Technician shall perform air monitoring, decontamination, and safety oversight activities on behalf of the SSHO. They shall have appropriate training equivalent to the SSHO in each specific area for which they have responsibility and shall report to and be under the supervision of the SSHO.

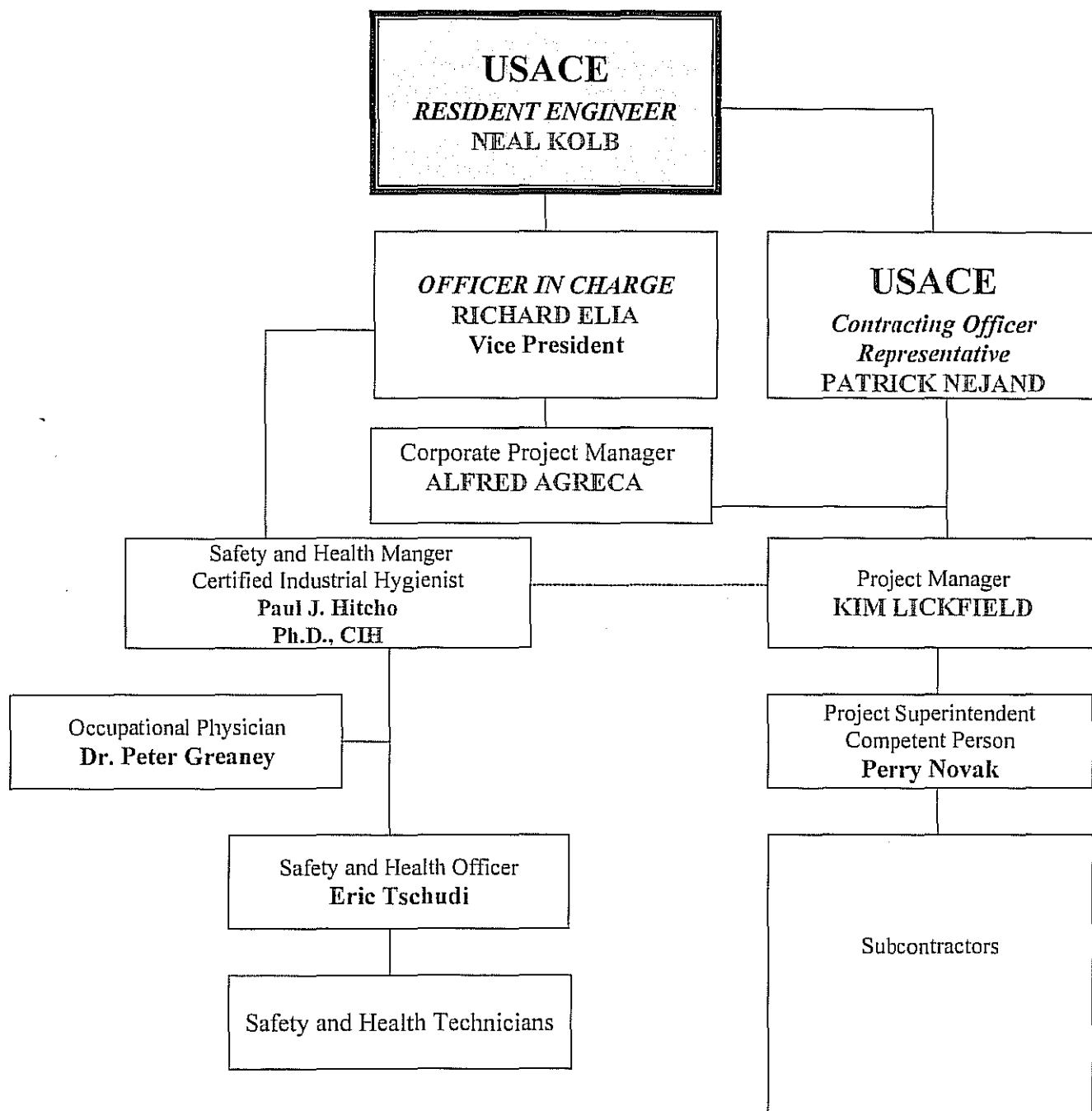
## **2.10 Subcontractors**

Subcontractors utilized during remedial activities at the Cornell-Dubilier Electronics Superfund Site are covered by this SSHP and will be provided a copy of the plan prior to commencing work. The Severson SSHO will verify that subcontractor employee training, medical clearance, and respirator fit test records are current and will monitor and enforce compliance with the established plan and standard operating procedures. As with all site personnel, subcontractors will be briefed on the provisions of this plan and attend all daily toolbox and weekly safety meetings.

Severson will continually monitor a subcontractor's safety performance. Severson will observe subcontractors for hazards or unsafe practices that are both readily observable and occur in common work areas. The SSHO will note subcontractor work practices on the daily Safety and Health report. If non-compliance or unsafe conditions or practices are observed, the subcontractor safety representative will be notified and corrective action will be required. The subcontractor will determine and implement necessary controls and corrective actions. If repeat non-compliance/unsafe conditions are observed, the subcontractor will be required to stop affected work until adequate corrective measures are implemented.

The major subcontractor for this project will be the operator of the LTTD unit. They will be required to prepare an amendment to this plan which outlines the procedures for the safe operation of the unit.

Figure 2 - Organizational Chart



### 3.0 HAZARD/RISK ANALYSIS

Uncontrolled hazardous material sites can cause a multitude of health and safety concerns, any of which can result in serious injuries and/or illnesses of workers. Some hazards are a function of the

physical, biological, or chemical nature of the site itself. Others are a direct result of the construction being done. Based upon the information provided to Severson regarding the primary historical uses of the property and the knowledge of the current conditions, the overall Safety and Health hazard assigned to the contemplated activities at the Site is determined to be moderate.

Work includes excavation, stockpiling, segregating, and treatment of contaminated soils; sampling and analysis of soil, water, air; transportation and disposal; and site restoration. All aspects of the work will be described in the Remedial Action Work Plan submitted under a separate cover.

Severson has developed an Activity Hazard Analysis (AHA) for major phases of work of the remedial action. A major phase of work is defined as an operation involving a type of activity presenting hazards not experienced in previous operations, or where a new subcontractor or work crew is to perform the specified phase. The analysis will define the activity being performed and identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard. An AHA will also be prepared when new tasks are added, job situations change, or when it becomes necessary to alter safety requirements. Work will not proceed on a particular task/work area until the AHA has been reviewed and a preparatory meeting has been conducted. General hazards associated with remedial activities are described below.

A preparatory meeting will be conducted by the SSHO for site personnel prior to their initiating any new or differing site activities. At the preparatory meeting, the SSHO will ensure that site personnel are knowledgeable of the SSHP and understand the hazards and controls of the activity to be performed.

AHAs have been prepared for the major features of work to be completed at the Site and are located in the Accident Prevention Plan.

#### **4.0 SAFETY AND HEALTH TRAINING**

Consistent with OSHA's 29 CFR 1910.120 regulation covering Hazardous Waste Operations and Emergency Response, all Site personnel who will be performing remedial activities, intrusive sampling, emergency response operations, or come in contact with contaminated material are required to be trained in accordance with the standard.

##### **4.1 General Hazardous Waste Operation Training**

Prior to arrival on-site, Severson will be responsible for certifying that the employees meet the requirements of pre-assignment training, consistent with OSHA 29 CFR 1910.120 paragraph (e)(3). Severson will provide documentation certifying that each general Site worker has received a minimum of 40 hours of instruction off site, and a minimum of three days actual field experience under the direct supervision of a trained, experienced supervisor. All personnel must also receive 8 hours of refresher training annually. At no time should anyone be working on-site without the minimum training requirements. Consistent with OSHA 29 CFR 1910.120 paragraph (e)(4), individuals designated as Site Supervisors require an additional 8 hours of training. A certificate of Worker/Visitor Acknowledgement will be completed and submitted for each site worker and visitor who will enter the contamination reduction zone, and/or exclusion zone.

## **4.2 Preparatory Meetings**

Preparatory meetings will be conducted by the SSHO for site personnel prior to their initiating any new or differing site activities. At the Preparatory meetings, the SSHO will ensure that site personnel are knowledgeable of the SSHP and understand the hazards and controls of the activity to be performed (review Activity Hazard Analysis).

## **4.3 Site-Specific Training**

All personnel working at the Site during remedial activities will review this SSHP with the SSHO. Personnel will sign an acknowledgment form to document their review and agreement to comply with the provisions of the SSHP. All visitors must sign the visitor's log and wait in the Severson field office for a briefing before entering the Site.

The SSHO will be responsible for ensuring Site visitors are trained in the hazard associated with the Site, to explain emergency procedures, and instruct them in the use of protective gear required during the visit. Visitors meeting requirements of HAZWOPER may be allowed in the Exclusion Zone if conditions permit and if escorted by the SSHO.

### **4.3.1 Initial Session**

Prior to commencement of onsite field activities, all site employees will attend a site-specific safety and health training session. This session will be conducted by the SSHO or designee, to ensure that personnel are familiar with the requirements of this Site-Specific Safety and Health Plan. The initial session will consist of the contents of this SSHP and specific procedures developed for the project. The SSHO or designee will also provide initial site-specific training for replacement employees.

As a minimum the site-specific training will include:

- Explanation of the SSHP.
- Health and Safety Personnel and Organization.
- Special attention to signs and symptoms of overexposure to known and suspected site contaminants.
- Health effects of site contaminants.
- Air monitoring description.
- Physical hazards associated with the project.
- Selection, use, and limitations of available safety equipment and proper procedures for its use.
- Personal hygiene and decontamination.
- Respirator fit testing.
- PPE fitting to determine proper size for individuals.

- Site rules and regulations.
- Work zone establishment and markings.
- Site communication and the "Buddy System".
- Emergency preparedness procedures.
- Equipment decontamination.
- Medical monitoring procedures.
- Review applicable Severson Standard Operating Procedures.
- Site Specific Hazard Communication.
- Lead Awareness Training

#### **4.3.2 Periodic Sessions**

Periodic training will be provided at least weekly and prior to each change of operation. The training will address safety and health procedures, work practices, any changes to SSHP, review activity hazard analysis, work task or schedule, results of previous week's air monitoring, and review of safety discrepancies and accidents.

#### **4.4 Training for Hazardous Materials Shipments**

Training for hazardous materials shipments will be provided to site personnel in accordance with 49 CFR 172 Subpart H. This training will be task specific for any employee who handles, prepares, offers, or accepts hazardous materials. This training is required initially and every 3 years after that, unless there are changes in rules, regulations, manifests, or procedures.

#### **4.5 Safety Meetings**

A well-ordered flow of information is essential to a good safety program. Severson, through a program of safety meetings at all levels, intends to accomplish the goals of safety awareness, education, and participation.

The SSHO will conduct daily safety meetings with ALL on-site personnel. An opportunity will be provided for employees to voice safety-related concerns. The SSHO will submit a synopsis of each meeting including topics covered, safety-related concerns, action items to be addressed, status of previous items, and a signed attendance list.

#### **4.6 Hazard Communication Training**

OSHA's standard for hazard communication requires that all workers be informed of potentially hazardous materials used in their work area. Severson provides employees with information and training on hazardous chemicals at their work site at the time of their initial assignment, annually, and whenever a new chemical is introduced into their work site that could present a potential hazard. Personnel are briefed on the general requirements of the OSHA hazard communication standard and

duty-specific hazards by their immediate supervisor before they begin any duties on the work site. Personnel transferred from another site are also briefed on the duty-specific hazards by their immediate supervisor before they begin any duties on the work site.

#### **4.7 Excavation/Trenching Competent Person**

Supervisory and other essential personnel engaged in excavation activities are required to complete Competent Person Training. This training provides knowledge about soil analysis and classification, use of protective systems, and the requirements of Excavation Standards. The Site Superintendent and the SSHO are designated Excavation/Trenching Competent Persons for this project.

#### **4.8 First Aid/CPR Training**

At least two site personnel will be required to complete first aid and cardiopulmonary resuscitation (CPR) training and receive the appropriate certification. CPR certification is renewed annually; first aid certification is renewed every three years. All first aid/CPR training is American Red Cross, American Heart Association approved or in accordance with OSHA standards. Additionally, First Aid/CPR qualified personnel will have received blood borne pathogen training as required by 29 CFR 1910.1030.

### **5.0 PERSONAL PROTECTION EQUIPMENT**

The PPE Program will be implemented for work at the Site. The PPE requirements for the Site are located in section 11 of the APP.

### **6.0 MEDICAL SURVEILLANCE PROGRAM**

The Medical Surveillance Program is designed to track the physical condition of employees on a regular basis as well as survey pre-employment or baseline conditions prior to potential exposures. The Medical Surveillance Program is a part of the overall Severson Safety and Health program.

#### **6.1 Baseline Medical Monitoring**

Each employee must receive a baseline physical, which can be part of an annual medical monitoring program, prior to being permitted to enter the Exclusion Zone or Contamination Reduction Zone. The content of the physical has been determined by Severson's Occupational Physician as suggested by NIOSH/OSHA/USCG/EPA's Occupational Safety & Health Guidance Manual for Hazardous Waste Site Activities. The minimum medical monitoring requirements for work at the Site are as follows:

- Complete medical and work histories
- Physical examination
- Pulmonary function tests (FVC and FEV1)
- Blood chemistry (CBC & SMAC 24)
- Urinalysis with microscopic examination
- Audiometric Testing

- Eye examination and visual acuity
- Chest X-Ray (as directed by the Occupational Physician)
- Electrocardiogram (as directed by the Occupational Physician)
- Other Biological testing as prescribed by the Occupational Physician
- Serum Lead
- Zinc Protoporphyrin
- Serum PCB

The medical surveillance provided to the employee includes a judgment by the medical examiner of the ability of the employee to use either positive- or negative-pressure respiratory protection equipment. Any individual found to have a medical condition, which could directly or indirectly be aggravated by exposure to these site contaminants, will not be employed for the project. Individuals not capable of satisfying the project requirements for wearing respiratory protection equipment will be evaluated on a case-by-case basis prior to being employed. A copy of the medical examination is provided to the employee.

The employee will be informed of any medical condition(s) that would result in work restriction or that would prevent him from working at hazardous waste sites.

## **6.2 Periodic Monitoring**

In addition to a baseline physical, all employees require a physical every 12 months unless the advising physician believes a shorter interval is appropriate. The Occupational Physician has prescribed an adequate medical evaluation, which fulfills OSHA 29 CFR 1910.120 requirements. The pre-assignment medical outlined above is applicable.

All personnel working on the Site that enter an active Exclusion or Contamination Reduction Zone will verify currency (within 12 months) with respect to medical monitoring. Severson will obtain a copy of the physician's written opinion detailing the employee's ability to perform hazardous waste site work.

At termination of employment or reassignment to an activity or location that does not represent a risk of exposure to hazardous substances, an employee may be required to take an exit physical. If his/her last physical was within the last 6 months, the advising medical consultant has the right to determine adequacy and necessity of an exit exam.

## **6.3 Exposure/Injury/Medical Support**

As a follow-up to an injury or possible exposure above established exposure limits, all employees are entitled to and encouraged to seek medical attention and physical testing. Depending upon the type of exposure, it is critical to perform follow-up testing within 24-48 hours. It will be up to the occupational health physician to advise the type of test required to accurately monitor for exposure effects.

Any employee, who develops a loss time illness exceeding one working day, or injury during the period of the contract, must be evaluated by the occupational health physician. A written statement indicating the employee's fitness, signed by the occupational physician must be submitted prior to the employee entering the work site.

Any employee who has a blood lead level greater than 50 ug/dl shall be removed from any work that involves lead exposure. The employee may return to work once their blood lead levels are less than 40 ug/dl.

#### **6.4 Medical Records**

The results of medical testing and full medical records will be maintained in accordance with 29 CFR Part 1910.1020. A copy of the medical certification will be kept on the Site for each person entering the Contamination Reduction Zone and Exclusion Zone.

### **7.0 EXPOSURE MONITORING/AIR SAMPLING PROGRAM**

This air-monitoring plan will serve to outline procedures to identify and quantify airborne chemical contaminants at the Cornell-Dubilier site. Both real-time monitoring and air sampling will be conducted throughout the duration of the project to establish the maximum levels of personal protection required, as well as to verify that worker exposure levels and respiratory protection are adequate. Additional monitoring will be performed for the protection of the public and the environment. Available site information indicates that the primary concerns with respect to contamination at the site are related to inhalation of particulates. As a result, engineering controls will be utilized to the maximum extent possible to control the production of dusts during the project. Engineering controls may include the use of tarps or coverings, water misting or dust control additives. A portable meteorological station will be installed in conformance with the EPA Ambient Monitoring guidelines for the measurement of wind speed, wind direction ambient air temperature, atmospheric pressure, humidity, solar insolation, and precipitation. The station will be installed in an area relatively free of trees and houses. The station will include a continuous readout temperature gauge and a rainfall gauge and will produce a 24-hour average figure for each parameter so that the weather influences on the air samples can be characterized. In addition, visual wind direction indicators will be established in a central location at each active work area. Meteorological monitoring results will be documented in the daily safety log.

#### **7.1 Real-Time Air Monitoring**

##### **7.1.1 Organic Vapor Monitoring**

During the remedial activities, organic vapor levels will be monitored initially and every 30 minutes during intrusive activities with a Photo Ionization Detector (PID) set at the appropriate span setting and equipped with a 10.6 eV probe or equivalent device (a copy of the PID Operator's Manual will be kept on-site). The frequency may increase or decrease by the SSHO based on site conditions. Monitoring for organic vapor concentrations will consist of measurements taken within 10 feet (downwind) of each active work area. Real-time air monitoring equipment calibration will be performed in accordance with the manufacturer's recommendation prior to field use. Calibration information will be recorded on the Daily Air Monitoring Report. Maintenance and calibration procedures for all air monitoring devices will be maintained on site. Refer to *Table 4 – "Operational Action Levels"*

### 7.1.2 Combustible Gases/Carbon Monoxide/Oxygen Levels/Hydrogen Sulfide

A Multi-RAE or equivalent Portable Gas Monitor will be utilized to monitor for explosive, oxygen enriched/deficient atmospheres and concentrations of hydrogen sulfide initially and every 30 minutes during sub grade work within 10 feet of active work areas and at a minimum of two locations near the site perimeter alternating between the Lehigh Valley RR and Factory Street borders and the Spicer Avenue and Hamilton Boulevard borders. A copy of the instrument Operator's Manual will be kept on-site. The Portable Gas Monitor will be utilized for all intrusive remediation activities and activities where the potential for disruption of utilities exists. Calibration information will be recorded on the Daily Air Monitoring Report. Maintenance and calibration procedures for all air monitoring devices will be maintained on site.

### 7.1.3 Particulate Monitoring

Continuous real-time air monitoring for dust will be performed within 10 feet (downwind) at appropriate areas adjacent to excavation, fill placement and compaction, and LTDD activities. Air monitoring will be performed at the work area using a MIE, PDR 1000 Personal/Data RAM or equivalent Particulate Monitor. In addition to the monitoring in the work area, readings will be collected at a minimum of four locations near the site perimeter alternating between the Lehigh Valley RR and Factory Street borders and the Spicer Avenue and Hamilton Boulevard borders. Real-time air monitoring equipment calibration will be performed in accordance with the manufacturer's recommendation prior to field use. Calibration information will be recorded on the Daily Air Monitoring Report. Maintenance and calibration procedures for all air monitoring devices will be maintained on site.

### 7.2 Personal Air Sampling

In addition to the real-time monitoring performed during demolition, excavation and material handling activities, the personal air-monitoring program will provide for the determination of worker's airborne exposure levels to PCBs and Lead. Such a determination will be made from laboratory analysis of air samples collected from workers during an 8-hour work shift. The selection of the worker to be monitored for occupational exposure will be done by the SSHO. This decision is based on his professional judgment for the physical characteristics of the job and contamination levels in each work area. Personal sampling will be conducted in a manner representative of exposure to workers at those locations or jobs where the potential for maximum exposure is predicted. Personal air monitoring results will be used to verify personnel exposure during the project. Refer to *Table 1 – "Personal Air Monitoring"*

Table 1  
Personal Air Monitoring

Contaminant	Task/Activity	Type of Sample	Sampling Method	Analysis Method
Lead	Excavation and Soil Handling Activities	Breathing Zone	Personal	NIOSH 7105
PCBs	Excavation and Soil Handling Activities	Breathing Zone	Personal	NIOSH 5503
Benzene	Excavation and Soil Handling Activities	Breathing Zone	Personal	NIOSH 1500
TCE	Excavation and Soil Handling Activities	Breathing Zone	Personal	NIOSH 1022
Vinyl chloride	Excavation and Soil Handling Activities	Breathing Zone	Personal	NIOSH 1007

Personnel exposures will be evaluated by sampling in accordance with NIOSH Method 7105 for lead, NIOSH Method 1500 for benzene, NIOSH Method 1022 for TCE, NIOSH Method 1007 vinyl chloride, and NIOSH Method 5503 for PCBs using personnel sampling pumps. This method uses small, portable air sampling pumps that are worn by workers. To quantify worker exposures, the samples are collected in the personal breathing zone of workers for a minimum duration of 7 hours. At least twice per week, the SSHO will designate at least one person per work shift in each active work area to wear the sampling device. In general, samples will be collected from those workers where site conditions represent the highest potential for occupational exposure.

### 7.3 Perimeter Air Monitoring

Perimeter air monitoring will be performed during remediation and LTTD activities at the Site. A Perimeter Air Monitoring Program has been developed under separate cover and shall be used to supplement the SSHP.

### 7.4 Continuous Emission Monitoring

During LTTD activities, stack emissions will be continuously conducted and recorded. Monitoring at a minimum shall include carbon monoxide, oxygen, and total nonmethane hydrocarbons. This monitoring will be conducted in accordance with NJDEP Air Quality Permit Equivalency issued by the NJDEP Bureau of Technical Services per New Jersey Administrative Code 7:27-8.

### 7.5 Operational Action Levels

The action level for total particulate is based on the highest reported concentration of the mixture of the particulate contaminants of concern. The action level is calculated by the following formula:

$$\text{Action level} = \frac{(1.0E+06)/(\text{Safety Factor})}{\text{Sum of } [(mg/kg)/\text{Exposure Limit}]}$$

Table 2 shows the contaminants of concern, their maximum soil concentrations, the exposure limit for each of these compounds, and the dust exposure limit for the mixture. The dust exposure limit is calculated to be 0.95 mg/m<sup>3</sup> and based upon this we have established a total particulate action level of 1.0 mg/m<sup>3</sup>.

Dioxin has not been included in the data set due to its limited presence at the Site. Material around soil boring 39 reported a maximum concentration of 11 ug/kg. Given the small value of dioxin present compared to the exposure limit recommended by the National Research Council of 10E-08 mg/kg/day. The real time dust quotient for exposure for a 70 kg person would be 63 mg/m<sup>3</sup>.

### 7.6 Noise

Noise is generated during remedial activities in such operations as transportation of materials and operation of heavy construction equipment. Noise has been defined as unwanted sounds. The human ear can tolerate a certain amount of sound without any harmful effects. Personnel will be provided protection against the effects of hazardous noise exposure whenever sound-pressure levels exceed 85 dB(A) steady-state expressed as a time-weighted average (TWA) or 140 dB(A) impulse in accordance with EM 385-1-1 05.C.01.

The USACE standard allows 90 dB (A) for a full 8 hours and for a lesser time when the levels exceed 90 dB (A). It is usually safe to assume that if you need to shout to be heard at arms length, the noise level is at 90 dB (A) or above. Hearing protection will be utilized by personnel operating or working around construction equipment or power tools. Based on the nature of activities to be performed on site, the use of heavy equipment, power tools, and other noise producing devices, Severson personnel are enrolled in a Hearing Conservation Program that meets the requirements of OSHA regulation 29 CFR 1910.95 as part of our Medical Surveillance Program.

Based upon Severson's past experience, it is known that the noise levels emanating from the operation of the heavy equipment often exceed what is allowable for worker exposure. Consequently, equipment operators and personnel working near the equipment are required to wear hearing protection. However, Severson will perform measurement with noise dosimetry to verify the effectiveness of the Hearing Conservation Program. Hearing protection equipment will be provided by Severson to all Site personnel needing them.

In addition to worker protection various noise interventions may be employed at the Site to control noise exposure to the public. The interventions may include, but are not limited to exhaust mufflers, whisper packs, protective shrouds, and fence line noise barriers. The specific methodologies will be evaluated during the startup phase of Site work. The SSHO and Site Superintendent will be responsible to ensure these engineering controls are in place and properly maintained throughout the duration of the project.

Table 2  
Dust Exposure Calculation Worksheet

DUST EXPOSURE CALCULATION WORKSHEET				
Dust Level		Safety Factor for this site = 4		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Barium	0.5	4,170	29.98	8.34E+03
Beryllium	0.002	11	46.34	5.40E+03
Cadmium	0.005	162	7.72	3.24E+04
Cobalt	0.02	141	45.05	5.55E+03
Copper	1	9,071	27.56	9.07E+03
Lead	0.05	7,460	1.68	1.49E+05
Manganese	0.2	1,300	38.46	6.50E+03
Mercury	0.025	8.1	771.6	3.24E+02
Nickel	1	377	663.13	3.77E+02
PCBs	0.5	22,000	5.68	4.40E+04
Selenium	0.2	12	4,237.29	5.90E+01
Zinc	2	4,040	123.76	2.02E+03
			Sum	2.63E+05
Dust Exposure Level at Mixture PEL =			0.950	

The action level for total VOCs is 1.0 ppm. This is based on the soil concentration, exposure limit and potential to become airborne. Table 3 shows these parameters, and it was determined that vinyl chloride and benzene are the VOCs of concern.

The action levels for lead, PCBs, benzene, and vinyl chloride are one half their OSHA permissible exposure levels.

Table 3  
"Worse Case" Organic Vapor Exposure Calculation

Soilvapor Name of Site	"WORST CASE" VAPOR EXPOSURE CALCULATION for volatile compounds in soil Carbon in Soil (frxn) 0.02						
PARAMETER:	Maximum Concentration in site soil (mg/Kg)	Vapor Pressure (torr)	Henry's Law Constant (atm m3/mol)	Worker Exposure Limit (ppm)	Saturation Concentr'n in Air (ppm)	Fraction of Total vapor in Air (fraction)	Saturation Concentr'n in Air frxn of PEL
CONTAMINANT							
Acetone	1.7	231.	3.97E-05	500	246.26	2.09%	0.49
Benzene	5.3	95.2	5.55E-03	0.5	332.03	2.82%	664.06
Carbon Disulfide	032	358.	1.44E-02	4	5.35	0.05%	1.34
Chlorobenzene	4.3	12.	3.77E-03	10	25.39	0.22%	2.54
Chloroform	003	197.	3.67E-03	2	.12	0.00%	0.06
1-2, Dichlorobenzene	58	1.36	1.90E-03	25	.34	0.00%	0.01
1-4, Dichlorobenzene	1.1	1.	2.40E-03	10	.8	0.01%	0.08
1,1-Dichloroethane	006	227.	5.62E-03	100	.67	0.01%	0.01
1,2-Dichloroethane	006	78.9	1.18E-03	1	.29	0.00%	0.29
Ethyl Benzene	36	9.6	7.88E-03	100	2.31	0.02%	0.02
Methyl Ethyl Ketone	017	95.3	5.69E-05	200	.84	0.01%	0.00
Methylene Chloride	019	435.	3.25E-03	25	4.99	0.04%	0.20
Naphthalene	130	.082	4.83E-04	10	29.94	0.25%	2.99
Styrene	032	6.4	2.75E-03	20	.12	0.00%	0.01
Tetrachloroethane	007	4.62	3.76E-04	1	.01	0.00%	0.01
Tetrachloroethylene	6.6	18.6	1.77E-02	25	34.2	0.29%	1.37
Toluene	7.5	28.4	6.64E-03	50	119.94	1.02%	2.40
1,1,1-Trichloroethane	002	124.	1.72E-02	350	.1	0.00%	0.00
Trichloroethylene	210	69.	9.85E-03	50	7,299.27	62.07%	145.99
Vinyl Chloride	2.8	2,980.	2.78E-02	1	3,643.42	30.98%	3,643.42
Xylenes	2.7	8.	6.68E-03	100	13.62	0.12%	0.14
Total Vapor	373.064	Combined Volatile Level (in ppm)			11,759.99		4,465.417 4,465.417

A decision-making protocol for an upgrade in levels of protection and/or withdrawal of personnel from an area based on atmospheric hazards is outlined in *Table 4 – "Operational Action Levels"*.

**Table 4**  
**Operational Action Levels**

<b>Active Work Area</b>		
<b>Type of Measurement</b>	<b>Concentration</b>	<b>Action</b>
Total Particulate	Less than 1.0 mg/m <sup>3</sup>	Continue work with air monitoring.
	Greater than 1.0 mg/m <sup>3</sup>	Upgrade to Level C PPE, initiate dust control measures.
Lead in air	Greater than 25 µg/m <sup>3</sup>	Upgrade to Level C PPE, initiate dust control measures.
PCBs	Greater than 250 µg/m <sup>3</sup>	Upgrade to Level C PPE
Total VOCs (Organic Vapors)	Less than 1 ppm above background	Continue work with air monitoring.
	Greater than 1 ppm but less than 5 ppm	Pull benzene and vinyl chloride tubes
	*Greater than 5 ppm above background sustained for 15 minutes	Upgrade to Level C PPE and collect benzene and vinyl chloride tube
	*Greater than 15 ppm above background for any period of time	Upgrade to Level C PPE and collect benzene and vinyl chloride tube
Benzene **Dräger tube 8101841 or equivalent	*Greater than 250 ppm above background for any for any two successive readings within a 15-minute period	Stop work, evacuate personnel upwind, notify Contracting Officer's Representative
	Greater than 0.5 ppm	Upgrade to Level C PPE
Vinyl chloride **Dräger tube 6728061 or equivalent	Greater than 10 ppm	Stop work; notify SHM and COR
	Greater than 0.5 ppm	Upgrade to Level C PPE
Combustible gas in air	Greater than 5.0 ppm	Stop work; notify SHM and COR
	> 10% LEL but < 25% LEL	Stop work; Ventilate workplace
Oxygen in air	> 25% LEL	Stop work; Evacuate area & investigate source
	Less than 19.5%	Stop work; Ventilate workplace
	Greater than 22%	Stop work; Ventilate workplace

\*These values are independent of benzene or vinyl chloride.

\*\* The tubes were selected for detection limit and limited interference with other chemicals associated with remediation.

**Continuous Emissions**

<b>Type of Measurement</b>	<b>Concentration</b>	<b>Action</b>
Carbon Monoxide	TBD	TBD
Oxygen	TBD	TBD
Total Non-Methane Hydrocarbons	TBD	TBD

## 8.0 HEAT AND COLD STRESS

### 8.1 Heat Stress

Heat stress may be a hazard for workers wearing protective clothing even if the temperature is moderate. The same protective materials that shield the body from chemical exposure prevent heat and moisture from dissipating. Personal protective clothing can therefore create a hazardous condition. Depending on the ambient temperature and the work being performed, heat stress can occur very rapidly - within as little as 15 minutes.

In its early stages, heat stress can cause discomfort and inattention, resulting in impaired functional abilities that can threaten the safety of both the individual and his co-workers. Personnel will be instructed to recognize the symptoms of the onset of heat stress. The SSHO may periodically check all personnel working in thermal stress areas to ensure that the symptoms are recognized. Frequency of heat stress monitoring and checks for symptoms of heat stress will increase with rises in air temperature, humidity, and the degree of exposure to high temperature areas.

When workers are in Level C PPE or higher, an ambient temperature of 72.5° F will be used as an action level to implement pulse monitoring, oral temperatures, and administrative controls, including rest breaks and work rotation to prevent employees from experiencing heat-related health effects including weight loss. The guidance for workers wearing permeable clothing is specified in the current version of the ACGIH Threshold Limit Values for Heat Stress. If actual clothing differs from the ACGIH standard ensemble in insulation value and/or wind and vapor permeability, changes should be made to the monitoring requirements and work rest period to account for these differences. *Table 5 – “Frequency of Physiological Monitoring”* provides the suggested frequency of physiological monitoring for fit and acclimatized workers.

Table 5 Frequency of Physiological Monitoring		
Adjusted Temperature Calculation	Normal Work Clothing	Impermeable Clothing
90 F (32.2 C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5 - 90.0 F (30.8 – 32.2 C)	After each 60 minutes of work	After each 30 minutes of work
82.5 - 87.5 F (28.1 – 30.8 C)	After each 90 minutes of work	After each 60 minutes of work
77.5 - 82.5 F (25.3 - 28.1 C)	After each 120 minutes of work	After each 90 minutes of work
72.5 - 77.5 F (22.5 - 25.3 C)	After each 150 minutes of work	After each 120 minutes of work

The following parameters should be used when monitoring workers:

**Heart rate** - Count the radial pulse as early as possible in the rest period to ensure a more accurate reading. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period at the same length. If, at the end of the following work period, the heart rate still exceeds 110 beats per minute, shorten the work period again by one-third.

**Oral Temperature** - The utilization of oral temperature applies to the time immediately after the worker leaves the contamination reduction zone. Using a clinical thermometer, take the temperature for three minutes. If the oral temperature exceeds 99.6 °F (37.6 °C), shorten the next work cycle by one-third, without a change to the rest period. If the oral temperature still exceeds 99.6 °F (37.6 °C) at the end of the following work period, shorten the next work cycle by one-third. Do not permit a

worker to perform duties requiring a semi permeable or impermeable garment if the oral temperature exceeds 100.4 F (38.1C). Ear canal readings are a valid method to monitor the temperature of workers who remain in the contamination reduction zone.

The oral temperature shall not exceed 100.4 °F. If an employee's pulse rate exceeds the maximum age-adjusted heart rate ( $0.7(220-AGE)$ ), and/or the oral temperature exceeds 100.4 °F, the employee shall be required to stop work and rest at the work site or move to an air-conditioned room after proper decontamination. The affected employee may be allowed to return to work after his/her pulse rate has dropped below 100 beats per minute. The SSHO in consultation with the affected employee, and medical personnel if necessary, shall determine whether an employee is ready to return to work. Fluids shall be provided and rest breaks will be taken. The frequency of breaks will increase with the temperature. Such things as cooling vests, portable fans, and breaks in air-conditioned areas shall be used if necessary.

When practicable, the most labor-intensive tasks should be carried out during the coolest part of the day. If necessary, a work/rest regimen will be instituted. The work/rest regimen consists of alternating periods of work and rest. The duration of these alternating periods will depend on the environmental conditions at the job site, such as, the Wet Bulb Globe Temperature, duration, and type of activities performed.

A worker who becomes irrational or confused, or collapses on the job should be considered a heat stroke victim and medical help should be called immediately. Early recognition of symptoms and prompt emergency treatment is the key to aiding someone with heat stroke. While awaiting the ambulance, begin efforts to cool the victim down by performing the following:

- Move the victim to a cooler environment and remove outer clothing.
- Wet the skin with water, and fan vigorously or repeatedly apply cold packs or immerse the victim in a tub of cool (not ice) water.
- If no water is available, fanning will help promote cooling.

Any individual showing susceptibility to heat stress will be referred to a physician for evaluation. In addition, the use of prescription drugs can also contribute to the effects of heat stress and will be considered during the assignment of work. Cool (50°-60°F) water or a sport drink, such as Gatorade, will be made available to workers and encourage them to drink small amounts frequently, (e.g., one cup every 20 minutes). Ample supplies of liquids will be placed close to the work area.

## 8.2 Cold Stress

Cold injury (frostbite and hypothermia) and impaired ability to work are hazards to persons working outdoors in low temperatures at or below freezing. Extreme cold for a short time may cause severe injury to exposed body surfaces (frost nip or frostbite), or result in profound generalized cooling (hypothermia). Areas of the body which have high surface area-to-volume ratio such as fingers, toes, and ears, are the most susceptible to frost nip or frostbite.

Two factors influence the development of a cold weather injury: ambient temperature and the velocity of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5

mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus, the body cools suddenly when chemical-protective equipment is removed if the clothing underneath is perspiration soaked. The wind chill factor is the cooling effect of any combination of temperature and wind velocity or air movement. **Table 6 – Wind chill Index** should be consulted when planning for exposure to low temperatures and wind. The wind chill index does not take into account the specific part of the body exposed to cold; the level of activity, which affects body heat production; or the amount of clothing being worn.

When practicable, the most sedentary tasks should be carried out during the warmest part of the day. If necessary, a light-work rotation schedule should be instituted or the work area heated. Heavy work that will cause heavy sweating resulting in wet clothing must also be monitored. The work/rest regimen consists of alternating periods of work and rest. The duration of these alternating periods will depend on the environmental conditions at the job site, (i.e., the Wind Chill Temperature, duration, and type of activities performed).

Table 6 Wind Chill Index													
Wind (mph)	Actual Temperature (° F)												
	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25
	Equivalent Temperature (° F)												
5	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40
10	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47
15	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51
20	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55
25	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58
30	22	16	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60
35	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62
40	20	13	6	-1	-8	-15	-22	-29	-36	-42	-50	-57	-64
Wind Chill (°F) = $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$ T = Air Temperature (°F) V = Wind Speed (mph)								Frostbite occurs in 15 minutes or less					

**Table 7 - Maximum Daily Time Limits for Exposure at Low Temperatures** gives the recommended time limits for working in various low temperature ranges.

Table 7 Maximum Daily Time Limits for Exposure at Low Temperatures	
Temperature Range (°F)	Maximum Daily Exposure
30 to 0	No limit, providing that the person is properly clothed.
0 to -30	Total work time: 4 hours. Alternate 1 hour in and 1 hour out of the low-temperature area.
-30 to -70	Two periods of 30 minutes each at least 4 hours apart. Total low temperature work time allowed is 1 hour.
-70 to -100	Maximum permissible work time is 5 minutes during an 8-hour working day. At these extreme temperatures, completely enclosed headgear, equipped with a breathing tube running under the clothing

and down the leg to preheat the air, is recommended.

**Table 8 - Work/Warm-up Schedule** applies to any 4-hour work period with moderate to heavy work activity, warm-up periods of ten (10) minutes in a warm location and an extended break (e.g., lunch) at the end of the 4-hour period in a warm location. For light-to-moderate work (limited physical movement) apply schedule one step lower. For example, at -35 °C (-30 °F) with no noticeable wind, a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period.

Table 8 Work/Warm-up Schedule											
Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph wind		15 mph wind		20 mph wind	
°C (approx.)	°F (approx.)	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks
-26° to -28°	-15° to -19°	Norm	1	Norm	1	75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	Norm	1	75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-Emergency Work Should Cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-Emergency Work Should Cease			
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-Emergency Work Should Cease					
-40° to -42°	-40° to -44°	30 min	5	Non-Emergency Work Should Cease							
-43° & below	-45° & below	Non-Emergency Work Should Cease									

To guard against cold injuries, workers should wear appropriate clothing and use warm shelters for removing personal protective equipment. The personnel decontamination trailer will be used as a warm shelter when required. The SSHO may periodically monitor workers' physical conditions, specifically checking for symptoms of frostbite.

## 9.0 ACCIDENT PREVENTION PROCEDURES/PRACTICES

### 9.1 Medical and First Aid Requirements

#### *Applicable Standards:*

*OSHA 29 CFR 1926.23, & 1926.50*

*USACE EM 385-1-1 Section 3 – Medical and First Aid Requirements*

First-aid kits/stations and required contents are maintained in a serviceable condition. Unit-type kits have all items in the first-aid kit individually wrapped, sealed, and packaged in comparable sized packages. First-aid stations will be located as close as practicable to the highest concentration of personnel. First-aid stations will be well-marked and available to personnel during all working hours. First-aid stations will be equipped with a first-aid kit, the size of which will be dependent upon the number of personnel normally employed at the work site.

Emergency telephone numbers and Route to the Area Hospital will be clearly posted and easily visible at all times. There should be OSHA posters prominently displayed and warning signs posted for any known or potential hazard(s) present. MSDSs must be available on the job site at all times.

## **9.2 Hazardous Substances**

### *Applicable Standards:*

*OSHA 29 CFR 1926.53 & 1910.1200*

*USACE EM 385-1-1 Section 6 – Hazardous Substance, Agents & Environments*

When hazardous substances are used in the workplace, the hazard communication program dealing with MSDSs, labeling, and employee training will be in operation. MSDS materials will be readily available for each hazardous substance used. A training program, plus regular question and answer sessions on dealing with hazardous materials will be given to keep employees informed. The program will include an explanation of what an MSDS is and how to use and obtain one; MSDS contents for each hazardous substance or class of substances; explanation of the "Right to Know"; identification of where employees can see the employer's written hazard communication program and where hazardous substances are present in their work area; the health hazards of substances in the work area, how to detect their presence, and specific protective measures to be used; as well as informing them of hazards of non-routine tasks and unlabeled pipes. A current monthly inventory will be maintained for all hazardous substances at the Site. This inventory will be kept readily available for emergencies and will be made available to the local fire department upon request.

## **9.3 Fall Protection**

### *Applicable Standards:*

*OSHA 29 CFR 1926.500, 501, 502, 503; 1926.106*

*USACE EM 385-1-1 Section 21 - Safe Access And Fall Protection*

To access high and low places on jobsites a variety of equipment may be used such as ladders, scaffolding, suspended platforms, aerial lifts, stairways, and climbing lines. The use of these access systems often presents fall hazards. In addition, employees may be exposed to falls while working on elevated structures, climbing onto and off of equipment, and even while walking by falling through holes or by slipping or tripping.

To protect employees when they are exposed to fall hazards, some form of fall protection must be used. The most common forms of fall protection are guardrails, personal fall arrest systems, hole covers, and safety nets. Any one, or all of these forms of fall protection may be used on construction worksites. The current OSHA standards also require that employees receive training regarding fall protection issues, and that the training is documented. An alternate fall arrest program may be implemented in cases where none of the traditional methods of fall protection are feasible. Components of our fall protection plans are listed below:

**Personal Fall Arrest System** - The three main parts of a personal fall arrest system are the full body harness, the lanyard/lifeline, and a suitable anchorage. Particular attention must be paid to the

anchorage point(s) to ensure that they are capable of supporting 5,000 lb. (22.2 kN) or two times the maximum load on an engineered system.

**Guardrail Systems** - Guardrail systems consist of a toprail, midrail, and if necessary a toeboard. Guardrail systems can be made of various materials, and they must be capable of supporting a 200-pound force.

**Training** - All employees must receive training on the nature of the fall hazards at the site and on how to avoid falls. Employees should be familiar with the use of all personal fall arrest systems and must wear the equipment when necessary.

The requirements of all applicable OSHA regulations notwithstanding, the minimum fall protection requirements on our projects may include the following:

- All fall protection systems must meet the requirements of Part 1926, Subpart M.
- For situations where lifelines are interrupted, double lanyards are necessary to ensure that the worker is continuously protected from falling by attaching one lanyard ahead of the discontinuity prior to unhooking the trailing lanyard.
- Climbing on forms, false work, or the structure to gain access to work areas is expressly prohibited. However, it is not intended to prohibit the use of ladders for access to work areas, provided the operation is in compliance with OSHA Part 1926 Subpart X and other relevant requirements.
- Where scaffolds are necessary to provide temporary access to work areas, they must be in compliance with §1926.451. Scaffolds must include a toprail, midrail, and toeboard in compliance with 1926.451, on all open sides and ends. Personal fall arrest systems meeting the criteria of Part 1926 Subpart M are required to protect workers during installation and removal of the railings, and in situations where physical restrictions preclude installation of a standard railing.
- Fall protection is required for open sides or ends of roofs and for openings in floors, as required in Part 1926 Subpart M. In no case will a height of fall 6 feet (1829 mm) or greater from the side, end, or opening in a floor remain unprotected.
- All workers in approved personnel aerial lifts must use a personal fall arrest system meeting the criteria of Part 1926 Subpart M, with the lanyard attached to the boom or basket, as required by OSHA 1926.556.
- Because falls from structural members constitute a serious and clearly recognizable hazard, fall protection, if necessary, for all steel or concrete beams and other structural elements must be in place prior to removal. This fall protection will consist of personal fall arrest systems, safety nets, or other means meeting the requirements of Part 1926 Subpart M.
- Instances in which it is impossible to provide fall protection for workers are rare. Where an individual worker must rig the fall protection system, and it cannot be accomplished from an aerial lift or by tying-off to the existing structure, momentary exposure to a fall hazard may be unavoidable. It is essential that adequate planning of construction procedures minimize such

occurrence of unprotected exposure to fall hazards. It is equally essential that the fall protection systems utilized actually enhance safety, rather than creating a secondary hazard.

#### 9.4 Electrical

##### *Applicable Standards:*

*OSHA 29 CFR 1926.400 through 449, 1910.301 through 399, 1926.550(a)(15)*

*USACE EM 385-1-1 Section 21- Electrical*

Electricity is a serious workplace hazard that must be respected at all times. It is important to remember that exposure to even a little electric current can kill! The best protection around electricity is distance -- ample distance between the worker and the conductive materials. The following safe work practices and procedures will help prevent electrical accidents on the jobsite.

Workers should observe and strictly obey all warning and danger signs around electrical apparatus. They should never close a switch that has a danger tag on it signed by or placed there by someone else. Untrained people must not open any electrical enclosures. The one exception is that the door on a circuit breaker panel board may be opened to operate the switches, but other types of electrical enclosures should not be opened.

Extension cords or any power tools or equipment must not be used when the cords are frayed, worn out, or the wires are bare. Defective equipment should be reported to the supervisor and turned in for repair. Report all unguarded or broken light bulbs. Do not hang lights by their cords unless the light was designed to be suspended in that manner.

**Installation Safety Requirements:** Live parts of electrical equipment operating at 50 volts or more must be guarded against accidental contact. Entrance to rooms and other guarded locations containing exposed live parts must be marked with conspicuous warning signs forbidding unqualified persons from entering. All pull boxes and breaker boxes must be labeled to indicate the equipment they switch. Electric installations that exceed 600 volts and that are open to unqualified persons must be made with metal-enclosed equipment or enclosed in a vault or area controlled by a lock. In addition, equipment must be marked with appropriate caution signs.

Conductors and equipment must be protected from over current in accordance with their ability to safely conduct current, and the conductors must have sufficient current carrying capacity to carry the load. Fuses and circuit breakers must also be located or shielded so that employees will not be burned or otherwise injured by their operation.

All wiring components and utilization equipment in hazardous locations must be maintained in a explosion-proof condition without loose or missing screws, gaskets, threaded connections, seals, or other impairments to a tight condition. Unless identified for use in the operating environment, no conductors or equipment can be located:

- In damp or wet locations.
- Where exposed to gases, fumes, vapors, liquids, or other agents having a deteriorating effect on the conductors or equipment.

- Where exposed to excessive temperatures.

**Ground Fault Circuit Interrupters** To ensure electrical safety from shocks on all construction sites, all 120-volt, single-phase, 15- and 20-amp receptacle outlets and portable generators must be protected by ground fault circuit interrupters (GFCIs), or assured equipment grounding conductor program must be established. In an assured equipment-grounding program, one or more **competent persons** must be designated to implement and enforce the following assured equipment grounding safety procedures at all construction jobsites.

Each 120-volt extension cord, tool, piece of equipment, and receptacle needs to be inspected and tested before first use, before equipment is returned to service following repairs, and before equipment is used after any incident that can be reasonably suspected to have caused damage.

Each extension cord, tool, or piece of equipment should be visually inspected by the user before each day's use to determine signs of damage. Equipment found to be damaged or defective (frayed or damaged insulation, crushed cable, loose or missing covers or screws, and missing ground prong on plugs, etc.) must not be used until repaired. Equipment suspected to be damaged or defective should be inspected and tested prior to use.

**Overhead Transmission and Distribution Lines** - A significant hazard on construction jobsites is the accidental contact of moving equipment with live overhead power distribution and service lines. Where work must be done near live lines, the movement of all equipment such as cranes, excavators and other equipment must be guided by an observer who can observe the clearance of the equipment from energized lines and give timely warning to equipment operators. The minimum clearance between live lines and any jobsite equipment is 10 feet (3.0 m), and the clearance increases with increasing line voltages.

## 9.5 Lockout and Tagout

### *Applicable Standards:*

*OSHA 29 CFR 1926.417 & 1910.147*

*USACE EM 385-1-1 Section 12- Control of Hazardous Energy (Lockout/Tagout)*

Whenever maintenance, servicing, or repairs are done to equipment, tools and machinery, there is a potential for injury from the accidental energization or movement of the equipment. Prior to beginning any work on equipment, steps must be taken to identify the energy sources present in the equipment, and to ensure that the energy sources are neutralized.

Hazardous energy sources fall into categories such as electrical, pneumatic, hydraulic, and potential (gravity, springs, etc.). One simple control in the construction industry has been to unplug cord-connected equipment. Vehicles and other motorized equipment can be protected from accidental starting by disconnecting the battery. Other controls include the use of identifiable padlocks on disconnects, breaker switches, and valves. Stored energy has the potential for release with great kinetic force and potential for injury.

All machinery or equipment capable of movement must be de-energized or disengaged and blocked or locked out during cleaning, servicing, adjusting or setting up operations, whenever required. The

lockout procedure requires that stored energy (i.e. mechanical, hydraulic, air) be released or blocked before equipment is locked out for repairs. Appropriate employees are provided with individually keyed personal safety locks. Employees are required to keep personal control of their key(s) while they have safety locks in use. Employees must check the safety of the lockout by attempting a start up after making sure no one is exposed. Where the power disconnecter does not also disconnect the electrical control circuit, the appropriate electrical enclosures must be identified. The control circuit can also be disconnected and locked out.

Temporary electrical service installation will be performed by a qualified electrician. Work may only be performed on de-energized equipment. Lockout/Tagout procedures will be implemented to assure the safety of personnel during electrical work activities.

Underground electric lines will be located and clearly marked. These utilities will be protected, removed, or relocated as needed to do the work safely. The excavation work will not be allowed to endanger the underground utility or the people doing the work. Barricades, shoring, or other supports as needed, will protect utilities left in place that are exposed by the excavation.

## 9.6 Scaffolds

### *Applicable Standards:*

*OSHA 29 CFR 1926.451 through 454*

*USACE EM 385-1-1 Section 22 -- Work Platforms*

Use of scaffolds exposes workers to a number of different hazards. According to OSHA, the two predominant hazards when working on scaffolds are falling from the scaffold and being struck by a falling object while working on or below a scaffold. The falls are most commonly caused by either the planking or scaffold support structures giving way, or by falling off the edges of the work platforms. In addition to the fall hazards, workers have been electrocuted when either the scaffold structures or conductive tools and materials being used on the scaffold have come into contact with electrical sources.

In the OSHA standards all scaffolds are divided into two general classes, supported scaffolds or suspension scaffolds. A supported scaffold means, "one or more platforms supported by outrigger beams, brackets, poles, legs, uprights, posts, frames, or similar rigid support." A suspension scaffold is defined as "one or more platforms suspended by ropes or other non-rigid means from an overhead structure(s)."

A key requirement in the OSHA standards is that scaffolds can only be erected, moved, dismantled, or altered under the supervision of a competent person. Such activities can only be performed by experienced and trained employees that are selected by the competent person. Other duties of the competent person include:

- Determining if scaffold components from different manufacturers can be used together.
- Determining if galvanic actions are taking place when scaffolding materials of dissimilar metals are used together.

- Inspecting the inboard connections of outriggers to support structures before using suspension scaffolds.
- Inspecting wire ropes on suspension scaffolds before and after every shift.
- Evaluating how to keep suspension scaffolds from swaying.
- Determining whether and how a safe means of access can be provided to scaffold erectors.
- Determining when the weather is too severe to work on scaffolds.
- Determining when and how fall protection can be provided to employees erecting and dismantling scaffolds.
- Inspecting manila and synthetic ropes used as toprails and midrails for strength requirements as frequently as necessary.
- Providing work skills and safety training to all employees in scaffold work.

The general requirements for all scaffolds are covered in 1926.451. Guidance regarding scaffold capacities, platform construction, access, use, and fall protection are covered in this section. There are also generic criteria for all supported and suspended scaffolds. Some highlights of this section, including the following points:

- Each scaffold and scaffold component must be capable of supporting, without failure, its own weight and at least four times the maximum intended load applied or transmitted to it.
- Each suspension rope, including connecting hardware, used on adjustable suspension scaffolds will be capable of supporting, without failure, at least six times the maximum intended load applied or transmitted to that rope.
- Scaffolds must be designed by a qualified person and will be constructed and loaded in accordance with that design.
- Each platform will be fully planked or decked between the front uprights and the guardrails at the rear of the scaffold. The front edge of all platforms will not be more than 14 in (34.3 cm) from the face of the work, unless employees are provided some form of fall protection. Each end of a platform, unless it is cleated or hooked, must extend over the centerline of its support at least 6 in (15.2 cm) to ensure that the platform does not slip off its support.
- When a supported scaffold height-to-base-width ratio exceeds four to one (4:1), the scaffold must be restrained from tipping by guying, tying, bracing, or equivalent means.
- Supported scaffold poles, legs, posts, frames, and uprights will bear on base plates, mudsills, or other adequate firm foundation. Footings will be level, sound, rigid, and capable of supporting the loaded scaffold without settling or displacement.

- Suspension scaffold outriggers must securely support the scaffold. Requirements for outrigger connections to the roof or deck, counterweights, outrigger beams, wire ropes, hoists, and other suspension scaffold support devices are given in 1926.451(d).
- When scaffold platforms are more than 2 feet (0.6 m) *above or below* a point of access, portable ladders, hook-on ladders, stair towers (scaffold stairways/towers), stairway-type ladders (such as ladder stands), ramps, walkways, integral prefabricated scaffold access, or direct access from another scaffold, structure, personnel hoist, or similar surface will be used. Crossbraces will not be used as a means of access.
- Safe means of access for each employee erecting or dismantling a scaffold (using the devices or methods above) must be provided, where the provision of safe access is feasible and does not present a greater hazard. The competent person must determine the feasibility and safety of providing the various means of access.
- Scaffolds will not be moved horizontally while employees are on them, unless the scaffolds have been specifically designed for such movement.
- Scaffolds will not be erected, used, dismantled, altered, or moved such that they or any conductive material handled on them might come closer to exposed and energized power lines than 10 feet (3.0 m) plus 4 in (10.2 cm) for each 1 kilovolt (kv) of line voltage greater than 50 kv. For live insulated lines with less than 300 volts, the minimum distance will be 3 feet (0.9 m). Where possible, electrical lines should be de-energized or moved prior to the erection and use of scaffolds near the lines.
- Ladders will not be used on scaffolds to increase the working level height of employees. Ladders may, under certain circumstances, be used on "large area scaffolds." A large area scaffold is a supported scaffold erected over substantially the entire work area.
- Each employee on a scaffold more than 10 feet (3.0 m) above a lower level will be protected from falling to that lower level. Guardrail and/or personal fall arrest systems must be used as a means of fall protection.
- To the extent feasible and safe, each employee erecting or dismantling a supported scaffold must be provided fall protection. The competent person must determine the feasibility and safety of providing the fall protection during supported scaffold erection. During the deployment of suspension scaffolds, fall protection must also be provided whenever employees are exposed to a fall of 6 feet (1.8 m) or more.
- In addition to wearing hardhats, each employee on a scaffold will be provided with additional protection from falling hand tools, debris, and other small objects through the installation of toeboards, screens, or guardrail systems, or through the erection of debris nets, catch platforms, or canopy structures that contain or deflect the falling objects. Alternatively, employees must be kept out of areas where falling objects may strike them.

The scaffold standard requires general training for all employees who perform work while on scaffolds. These employees must be trained by a qualified person, and the training will include information about the nature of the electrical hazards, fall hazards, and falling object hazards associated with working on scaffolds. Additional training must be provided to those employees

involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting a scaffold. This additional training must be provided by a competent person, and will cover the safe means for accomplishing the tasks above. The training must also focus on the need for access provisions and fall protection during scaffold set-up, takedown, and maintenance activities.

## **9.7 Motor Vehicles and Mechanized Equipment**

### *Applicable Standards:*

*OSHA 29 CFR 1926.600 through 606, 1926.1000 through 1003*

*USACE EM 385-1-1 Section 16 – Machinery and Mechanized Equipment*

Many potential hazards are associated with the use of motor vehicles and mechanized equipment on construction projects. Motor vehicles may be involved in accidents due to mechanical failures or operator errors, resulting in injuries to operators themselves or to bystanders. To minimize accidents resulting from the use of motor vehicles, the following safety procedures need to be implemented and enforced on all company projects:

- All equipment left unattended at night, adjacent to highways or construction areas should have lights, reflectors, and/or barricades to identify location of the equipment.
- Supervisory personnel will ensure that all machinery and equipment is inspected prior to each use to verify that it is in safe operating condition.
- Rated load capacities and recommended rules of operation must be conspicuously posted on all equipment at the operator's station.
- Wire rope must be taken out of service when one of the following conditions exist:
  - In running ropes, six random distributed broken wires in one lay or three broken wires in one strand or one lay.
  - Wear of one-third the original diameter or outside individual wires.
  - Kinking, crushing, hoist caging, heat damage, or any other damage resulting in distortion of the rope structure.
  - In standing ropes, more than two broken wires in one lay in sections beyond connections, or more than one broken wire at an end connection.
- A fire extinguisher of 5 BC rating or higher should be available at all operator stations. Where ordinary combustible materials (wood, paper, plastics) are present, an extinguisher suitable for Class A fires should also be available for use.
- When vehicles or mobile equipment are stopped or parked, the parking brake must be set. Equipment on inclines must have the wheels chocked as well as the parking brake set.
- All vehicles or combinations of vehicles must have in operable condition at least:

- Two headlights.
- Two taillights.
- Brake lights.
- Audible warning device at operator's station.
- Seat belts properly installed.
- Appropriate number of seats for occupants.
- Service, parking, and emergency brake system.
- Operators should not travel in reverse with motor equipment having an obstructed rear view unless:
  - The vehicle is equipped with an audible, functioning reverse signal alarm.
  - The vehicle is backed up only under the guidance of an observer who says that it is safe to do so.
- Only those trained in the use of a specific type of machinery should be allowed to operate the machinery. Operators of heavy equipment and trucks greater than 26,000 lbs (11,794 kg) gross vehicle weight used in traffic must have a commercial drivers license.
- Materials handling equipment such as scrapers, front-end loaders, dozers, and similar equipment must be provided with Rollover Protective Structures (ROPS).
- Accessible areas within the swing radius of cranes, backhoes, and other rotating machinery need to be barricaded to prevent employees from being struck or crushed by the rotating parts of the machinery or their loads.
- Employees should not ride on or in motor vehicles unless seats with seat belts are provided.
- No operator is to leave the equipment with the engine running.

## 9.8 Hand and Power Tools

### *Applicable Standards:*

*OSHA 29 CFR 1926.300 through 307*

*USACE EM 385-1-1 Section 13 – Hand and Power Tools*

Tools are such a common part of construction work that it is difficult to remember that they may pose hazards. Workers must learn to recognize the hazards associated with the different types of tools and the safety precautions necessary to prevent injuries from those hazards. To prevent accidents resulting from the use of hand- and power-operated hand tools, management personnel need to implement and enforce the following safe work procedures on all construction jobsites.

Broken, defective, burned, or mushroomed tools should not be used. They should be reported and turned in for replacement. The proper tool and equipment should be selected and used for each task. For example, a wrench should not be used as a hammer or a screwdriver as a chisel. Leaving tools on scaffolds, ladders, or any overhead working surfaces is hazardous because they may fall. Racks, bins, hooks, or other suitable storage space must be provided to permit convenient arrangement of tools. Striking two hardened steel surfaces together is hazardous because pieces of metal may break off (i.e., two hammers, or a hammer and hardened steel shafts should not be struck together). The practice of throwing tools from one location to another, from one employee to another, or dropping them to lower levels will be prohibited. When it is necessary to pass tools or material under the above conditions, suitable containers and/or ropes must be used.

Wooden tool handles must be sound, smooth, in good condition and securely fastened to the tool. Sharp-edged or pointed tools should never be carried in employee's pockets. Only non-sparking tools will be used in locations where sources of ignition may cause a fire or explosion. Tools requiring heat-treating should be tempered, formed, dressed, and sharpened by workmen experienced in these operations. Tools designed to accommodate guards must be equipped with such guards when in use.

All rotating, reciprocating or moving parts of equipment (belts, gears, shafts, flywheels, etc.) must be guarded to prevent contact by employees using such equipment. Guarding must meet requirements set forth in ANSI B15.1-1953. All hand-held power tools (e.g., circular saws, chain saws, and percussion tools) without a positive accessory holding means must be equipped with a constant pressure switch that will shut off the power when pressure is released. A positive "on-off" control must be provided on platen sanders, grinders with wheels 2 inches in diameter or less, routers, planers, laminate trimmers, nibblers, shears, scroll saws, and jigsaws with blade shanks 1/4 in wide or less.

A momentary contact "on-off" control must be provided on all hand-held powered drills, tapers, fasteners drivers, horizontal, vertical and angle grinders with wheels greater than 2 inches in diameter. Besides safety hazards, the use of power tools sometimes creates potential health hazards as well. The use of jackhammer and chiseling equipment often results in silica and nuisance dust exposures that can sometimes be controlled by wetting the work surfaces. Many times, however, the use of dust/mist respirators is required to prevent overexposures.

In addition to dust hazards, the hand vibration inherent in the use of some power tools may result in a restriction of blood flow to the hands and fingers, causing numbness or tingling. If workers consistently experience these symptoms after the use of power tools, they should contact their supervisor so that steps may be taken to prevent further harm to the nerves and blood vessels in their hands. The use of a different tool, changes to the offending tool to reduce vibrations, and/or the use of special gloves may be recommended to deal with the vibration problems.

**Electric Tools** - Electric tools present several dangers to the user; the most serious is the possibility of electrocution. The following safe work procedures for electric tools must be implemented and enforced at all company construction projects. Tools must (1) have a three-wire cord with ground and be grounded, or (2) be double insulated, or (3) be powered by a low-voltage isolation transformer. A GFCI must be used or the tool must be double insulated to prevent the worker from electrical shock hazards. Never remove the third prong from the plug. Electric tools should be operated within their design limitations.

In general, gloves and safety footwear are recommended during use of electric tools. However, gloves should not be worn when they are a potential entanglement hazard with reciprocating or rotating tools.

When not in use, tools should be stored in a dry place. Electric tools should not be used in damp or wet locations.

**Powered Abrasive Wheel Tools** - Power abrasive wheel tools present a special safety problem because they may throw off flying fragments. The following safe work procedures for powered abrasive wheel tools need to be implemented and enforced at all company construction projects. Portable grinding tools must be equipped with safety guards to protect workers from flying fragments as well as the moving wheel surface. Inspecting and sound- or ring-testing abrasive wheels prior to mounting is required to ensure that they are free from cracks or defects. Checking to ensure that the abrasive wheel RPM rating is appropriate for the tool will also help prevent wheel failures. The following work rules are appropriate for using a powered grinder:

- Always use eye protection and a face shield.
- Turn off the power when not in use.
- Never clamp a hand-held grinder in a vise.
- To prevent the wheel from cracking, the user should ensure that it fits freely on the spindle.
- Grinding wheel users should never stand directly in front of the wheel during start-up because there is always a possibility that the wheel may disintegrate (explode) when accelerating to full speed.

**Pneumatic Tools** - Pneumatic tools are powered by compressed air and include chippers, drills, hammers, and sanders. The following safe work procedures for pneumatic tools must be implemented and enforced at all company construction projects. Pneumatic tools that shoot nails, rivets, or staples and operate at pressures more than 100 lbs/in<sup>2</sup> must be equipped with a special device to keep fasteners from being ejected unless the muzzle is pressed against the work surface. Eye protection is required and face protection recommended for employees working with pneumatic tools.

Hearing protection is required when working with noisy tools such as jackhammers. When using pneumatic tools, users should check to see that the tools are fastened securely to the hose to prevent the hose from becoming disconnected. All hoses exceeding ½" inside diameter must have a safety device at the supply source or branch line to reduce pressure in the event of hose failure.

Airless spray guns that atomize paints and fluids at high pressures (1,000 lbs or more per in<sup>2</sup>) must be equipped with automatic or visual manual safety devices that will prevent pulling the trigger until the safety device is manually released. Workers operating a jackhammer are required to wear safety glasses, safety footwear, and hearing protection. Compressed air guns should never be pointed toward anyone. A safety clip or retainer must be installed to prevent attachments from being unintentionally shot from the barrel of the tool.

**Liquid-Fueled Tools** - Liquid-fueled tools are usually powered by gasoline. Vapors that can burn or explode and give off dangerous exhaust gases are the most serious hazards associated with liquid-fuel

tools. The following safe work procedures for liquid-fueled tools need to be implemented and enforced at all company construction projects.

Gas or fuel should be handled, transported, and stored in approved flammable liquid containers. These containers, also known as safety cans, are no more than 5 gallons in capacity and have a spring-closing lid and spout cover that will safely relieve internal pressure when subjected to fire exposure. Before refilling the tank for a fuel-powered tool, the user must shut down the engine and allow it to cool to prevent accidental ignition of hazardous vapors. Effective ventilation and/or personal protective equipment is necessary when using a fuel-powered tool inside a closed area. Fire extinguishers must be readily available in the work area.

## 9.9 Fire Protection and Prevention

### *Applicable Standards:*

*OSHA 29 CFR 1926.150 through 159*

*USACE EM 385-1-1 Section – 9 Fire Prevention and Protection*

Fire on construction projects is a constant hazard that can cause loss of life, equipment and material. To assist in preventing fires on construction projects, all personnel must comply with the following safe work practices and procedures:

**Fire Protection** - Access to all available firefighting equipment must be maintained at all times. Firefighting equipment must be inspected monthly and maintained in operating condition. Defective or exhausted equipment must be replaced immediately. All firefighting equipment should be conspicuously located at each jobsite. One fire extinguisher, rated not less than 10A, should be provided for each 3,000 ft<sup>2</sup> of the protected work-zone area. Travel distance from any point of the protected work-zone area to the nearest fire extinguisher must not exceed 100 feet. Extinguishers exposed to freezing conditions will be protected from freezing. Employees should not remove or tamper with fire extinguishers installed on equipment or vehicles or in other locations unless authorized to do so or in case of fire. After using a fire extinguisher, it must be recharged or replaced with another fully charged extinguisher. Extinguishers must be selected based on the anticipated fire hazards. To aid in the proper selection of fire extinguishers, the classes of fires are as follows:

- Class A (wood, paper, trash) - use water, dry chemical, or foam extinguisher.
- Class B (flammable liquids, gas, oil, paints, grease) - use foam, carbon dioxide, or dry chemical extinguisher.
- Class C (electrical) - use carbon dioxide or dry chemical extinguisher.
- Class D (combustible metals) - use dry powder extinguisher only.

**Fire Prevention** - Internal combustion engine-powered equipment should be located so that exhausts are away from combustible materials. Smoking is permitted in approved areas, only. Project will be conspicuously posted, "No Smoking or Open Flame." Portable battery-powered lighting equipment must be approved for the type of hazardous locations encountered. Combustible materials must be

piled no higher than 20 feet (6.1 m). Depending on the stability of the material being piled, this height may be reduced.

Portable fire extinguishing equipment, suitable for anticipated fire hazards on the jobsite, must be provided at convenient, conspicuously accessible locations. Firefighting equipment must be kept free from obstacles, equipment, materials, and debris that could delay emergency use of such equipment. Employees should familiarize themselves with the location and use of the project's firefighting equipment. All oily rags, wastes, and similar combustible materials must be placed in metal containers. The containers must be emptied on a daily basis. Storage of flammable substances on equipment or vehicles should be prohibited unless such unit has adequate storage area designed for such use.

**Flammable and Combustible Liquids** - Explosive liquids, such as gasoline, will not be used as cleaning agents. Gasoline and similar combustible liquids must be stored, transported, and handled in approved and labeled containers in well-ventilated areas free from heat sources. Approved wooden or metal storage cabinets must be labeled in conspicuous lettering, "Flammable-Keep Fire Away." Storage in an approved storage cabinet should not exceed 60 gallons of flammable, or 120 gallons of combustible liquids. Storage of containers will not exceed 1,100 gallons in any one pile or area. Never place a pile or group within 20 feet of a building. A 12-foot wide access way must be provided within 200-feet of each container pile to permit approach of fire control apparatus.

The use of flammable liquids and spray finishing needs to conform to the requirements of 1926.66 and 1926.152. Paints and reducers should be stored away from heat sources and out of the sun. Airless spray-painting apparatus should be of a type approved for hazardous locations. Any electrically or fuel-powered equipment used to mix, convey, and spray flammable and combustible liquids must carry an approval from a nationally recognized testing laboratory. Pneumatically operated equipment is usually suitable for use with flammable and combustible finishes.

**Fire Extinguishers** - Portable fire extinguishers are provided in adequate number and type (10 lb. ABC) and are located throughout the site. Fire extinguishers are located in readily accessible locations. Fire extinguishers are recharged regularly and the date of last inspection noted on their tags. Extinguishers should be placed free from obstructions or blockage. All extinguishers must be fully charged and in their designated places unless in use. All employees are periodically instructed in the use of extinguishers and fire protection procedures. Fire Extinguishers will be located in the following areas:

- **Support Zone (Field):** (1) 10 lb ABC multipurpose dry chemical type fire extinguishers.
- **Contamination Reduction Zone:** (2) 10 lb ABC multipurpose dry chemical type fire extinguishers.
- **Exclusion Zone:** (1) 10 lb ABC multipurpose dry chemical type fire extinguishers.
- **Equipment:** All of Severson's heavy equipment will be supplied with ABC multipurpose dry chemical type fire extinguishers.

## 9.10 Confined Space Entry

*Applicable Standards:*

*OSHA 29 CFR 1910.146, 1926.21(b)(6)*

*USACE EM 385-1-1 Section 6.I – Confined Space*

A confined space is a space that is large enough and so configured that an employee can physically enter and perform assigned work, has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits) and is not designed for continuous employee occupancy. Simply working in a confined space is not necessarily a hazard. However, if certain hazardous conditions exist prior to, or are created during entry, then the confined space must be treated with utmost care.

Conditions that make a confined space especially dangerous (i.e., make it a permit-required space) are:

- Contains or has the potential to contain a hazardous atmosphere.
- Contains a material that has the potential for engulfing an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section.
- Contains any other recognized serious safety or health hazard.

A hazardous atmosphere includes spaces that may expose employees to flammable gases, vapors, mists, or dusts; to an oxygen deficiency (<19.5 percent) or oxygen enriched environment (>22.0 percent); to air contaminants in excess of the permissible exposure limit (PEL), or to any other atmospheric condition that is an immediate danger to life and health (IDLH).

When a permit-required space is present, the following hierarchy of controls should be used on the space:

- Avoid entry.
- Eliminate the hazards that make the confined space a permit-required space. Ventilation, lockout/tagout, block and bleed, and other procedures can be used to eliminate hazards. Hazard elimination must be verified by air monitoring and other test procedures.
- Eliminate the hazards to the point that only atmospheric hazards remain. Use the "atmospheric hazard only" procedures entry system discussed in 1910.146(c)(5).
- Minimize and control hazards to the fullest extent possible, and enter only after the requirements of a full permit entry have been satisfied.
- Middlesex County HAZMAT Squad has agreed to perform the confined space rescue in the event of an emergency. The South Plainfield Fire Department would handle any other type of emergency services at the Site. The Middlesex HAZMAT Squad and the South Plainfield Fire Department will be invited to visit the Site at the start of the project phase to familiarize themselves with the hazards. The Middlesex County HAZMAT number has been added to the emergency contact list.

Employees must receive training on confined spaces so that they will acquire the understanding, knowledge, and skills necessary for a safe entry into the confined space. Confined space training will be documented.

Sevenson's Confined Space Entry Program has been included as Appendix E to the APP.

## **9.11 Welding and Cutting**

### *Applicable Standards:*

*OSHA 29 CFR 1926.350 through 354*

*USACE EM 385-1-1 Section 10 – Welding and Cutting*

Welding and cutting operations present various safety and health hazards. Welding and cutting operations on lead-painted surfaces often create lead fumes by "boiling off" the lead. These lead fumes may cause lead poisoning if inhaled or ingested in excessive amounts. Other metal fumes such as iron oxide, chromium, zinc, manganese, and cadmium may also be present during welding and cutting operations. Safety hazards such as fire may result in fatalities, serious injuries, and/or property damage. Therefore, in an effort to eliminate or reduce the hazards associated with welding and cutting operations, the following rules and procedures shall be included and enforced in the welding safety program.

***Welding and Cutting*** - Only qualified welders shall be authorized to do welding, heating, or cutting. Inspect work areas for fire hazards and proper ventilation before welding or cutting. Avoid welding or cutting sparks and hot slag. Be alert to hot surfaces and avoid touching metal surfaces until they have cooled. Place compressed gas cylinders in an upright position and secure in place to prevent dropping or falling. Handle with extreme care and do not store near any sources of heat. Remove any combustibles when welding or cutting must be done. If removal is not feasible, cover combustibles with a noncombustible material. When welding near any combustible material, another employee must be posted to serve as a fire watch. Make sure this person has a fire extinguisher available and keep him/her in the area after welding/cutting is completed until all danger of fire is past.

A hot-work permit system will be implemented at the Site. When working in the vicinity of welding operations, wear approved eyewear and avoid looking directly at the flash as serious flash burns could result. When opening valves on tanks that have regulators installed, be sure the pressure adjustment screw is all the way out and do not stand in front of the regulator. An internal failure could rupture the regulator and cause the adjustment screw to become a missile.

Primers, paints, and other coatings should be removed, where feasible, from the area to be heated and for at least 4 inches on all sides.

***Gas Welding and Cutting*** - When transporting, moving, and storing compressed gas cylinders, always ensure that the valve protection caps are in place and secured. Secure cylinders on a cradle, slingboard, or pallet when hoisting. Never hoist or transport the cylinders by means of magnet or choker slings. Move cylinders by tilting and rolling them on their bottom edges. Do not allow cylinders to be dropped, struck, or come into contact with other cylinders violently. Secure cylinders in an upright (vertical) position when transporting by powered vehicles. Do not hoist cylinders by

lifting on the valve protection caps. Do not use bars under valves or valve protection caps to pry cylinders loose when frozen. Use warm, not boiling, water to thaw cylinders loose.

Remove regulators and secure valve protection caps prior to moving cylinders, unless cylinders are firmly secured on a special carrier intended for transport. Close the cylinder valve when work is finished, when cylinders are empty, or when cylinders are moved at any time. Secure compressed gas cylinders in an upright position (vertical) except when cylinders are actually being hoisted or carried. Oxygen cylinders shall be stored at least 20 feet from other combustible materials such as acetylene. Alternatively, oxygen and fuel gas cylinders may be separated by a 5 feet-high non-combustible barrier with at least a 30-minute fire resistance rating.

**Arc Welding and Cutting** - Use only manual electrode holders that are specifically designed for arc welding and cutting. All current-carrying parts passing through the portion of the holder must be fully insulated against the maximum voltage encountered to ground. All arc welding and cutting cables must be completely insulated, flexible type, and capable of handling the maximum current requirements of the work in progress. Employees shall report any defective equipment to their supervisor immediately and refrain from using such equipment. Shield all arc welding and cutting operations, whenever feasible, by noncombustible or flameproof screens to protect employees and other persons working in the vicinity from the direct rays of the arc.

**Fire Prevention** - Welders should locate the nearest fire extinguisher in their work area in case of a fire emergency. Fire extinguishing equipment must be immediately available in the work area. Never use matches or cigarette lighters to light torches. Use only friction lighters to light torches. Never strike an arc on gas cylinders. Move objects to be welded, cut, or heated to a designated safe location. If the objects cannot be readily moved, then all movable fire hazards in the vicinity must be taken to a safe place or otherwise protected. Fuel lines shall have flashback arrestors. Do not weld, cut, or heat where the application of flammable paints or the presence of other flammable compounds, or heavy dust concentrations creates a hazard. Additional employees must be assigned to guard against fire while the actual welding, cutting, or heating is being performed when the operation is such that normal fire prevention precautions are not sufficient. Prior to applying heat to a drum, container, or hollow structure, provide a vent or opening to release any built-up pressure during the application of heat. Never cut, weld, or heat on drums, tanks, process lines, or containers that have contained flammable liquids until they have been purged and cleaned.

## **9.12 Floor and Wall Openings**

### *Applicable Standards:*

*OSHA 29 CFR 1926.500 through 503*

*USACE EM 385-1-1 Section 24 - Floor And Wall Holes And Openings*

All floor openings must be guarded by a standard railing and toeboards or cover. Ladderway floor openings or platforms must be guarded by standard railings with toeboards on all exposed sides, except at entrance to opening, where a swinging gate allows passage through the railing. Barricades for warning workers of hazards must be at least 6 feet back from the edge of the hazard and 42 in high. Hole covers must be strong enough to support possible loads and secured in place to prevent slipping. Guard all open-sided floors or platforms 6 feet (1.8 m) or more above the adjacent floor or ground

level with a toprail, midrail, and toeboard. Guard all wall openings that have a drop of more than 4 feet (1.2 m), and where the bottom of the opening is less than 3 feet (0.9 m) above the working surface with a toprail, midrail, and toeboard. Do not store materials within 6 feet (1.8 m) of floor openings or the roof.

### 9.13 Trenching and Excavations

#### *Applicable Standards:*

*OSHA 29 CFR 1926.650 through 652*

*USACE EM 385-1-1 Section 25 – Excavation*

Trenching and excavation work presents a serious risk to all employees. The greatest risk is the cave-in of a trench or excavation. Cave-in accidents are much more likely to result in worker fatalities than any other excavation-related accidents. Other hazards include contact with buried utilities. Because of the hazards associated with excavation work, the following safe work practices and procedures will be implemented and enforced:

- Remove or support all surface encumbrances whenever their location creates a hazard to employees.
- Identify underground installation (e.g., sewer, utility, fuel) locations prior to opening an excavation. Contact utility companies or owners to advise on the proposed work and ask for the locations of utility underground installations prior to opening an excavation. Additionally, the New Jersey One Call (Dig Safely) can be contacted at 1-800-272-1000 for assistance in identifying utilities in your area.
- Retain a copy of the NJ One Call Markout Ticket and submit with the daily safety report.
- Verify underground utility marks against land surveyor maps to ensure mark outs are in the proper location.
- Protect, support, or remove underground installations, as necessary, to safeguard employees working in open excavations.
- Structural ramps used by employees as a means of access or egress from excavations must be designed by a **competent person**.
- Structural ramps for access and egress of equipment must be designed by a **competent person** qualified in structural design.
- All excavations or trenches that are 4 feet (1.2 m) or more in depth must have a stairway, ladder, ramp, or other safe means of access and egress within 25 feet (7.6 m) of travel in any direction.
- The edges of a trench or excavation must be barricaded when the excavation is not readily seen because of plant growth or some other visual barrier.
- No employees are permitted underneath loads handled by lifting or digging equipment.

- A warning system (e.g., barricades, signals, or stop logs) must be used when mobile equipment is operated adjacent to an excavation.
- Testing must be conducted in excavations where oxygen-deficient and/or toxic atmospheres exist or could reasonably be expected to exist before employees are permitted to enter excavations greater than 4 feet (1.2 m) in depth.

Take adequate precautions, such as proper respiratory protection or ventilation, to prevent employee exposure to oxygen-deficient and other hazardous atmospheres. Emergency rescue equipment must be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation.

Never work in excavations where water has accumulated or is accumulating, unless adequate precautions have been taken to protect against the hazards posed by water accumulation.

A **competent person** must conduct inspections of excavations prior to the start of work and as necessary throughout each shift. Inspections must also be made after every rainstorm. Precautions must be taken before employees enter *a trench of any depth* that shows signs of water accumulation or wall sloughing due to moisture. Preventive precautions include the use of support or shield systems to prevent cave-ins, and the use of water removal pumps.

Trenches 5-feet or more in depth must be shored, benched, or sloped back to an angle of incline required to prevent cave-ins. The angle of incline required varies with differences in the soil type, environmental conditions of exposure, and the application of surcharge loads. Any excavation in unstable soil may require shoring or sloping.

Backfilling and removal of trench boxes or supports will progress together from the bottom of the trench. Jacks, supports, or braces will be released slowly, and in unstable soil, ropes will be used to pull out the jacks and braces from above and clear of the excavation. All personnel will be clear of the trench.

Materials must be placed 2-feet or more from the edge of the excavation. Material must be placed at a distance to prevent excessive loading on the face of the excavation. Precautions must be taken to prevent such materials from falling into the excavation.

Excavations will be protected by the use of temporary fencing to ensure site personnel, visitors, or the public do not inadvertently fall into an excavation. Excavations will be protected in accordance with EM 385-1-1 section 25.B *Safe Access*.

## 9.14 Stairways and Ladders

### *Applicable Standards:*

*OSHA 29 CFR 1926.1050 through 1060*

*USACE EM 385-1-1 Section 21 Safe Access and Fall Protection*

Stairways and ladders are a major source of injuries and fatalities among construction workers. Because of the potential hazards involved in using stairways and ladders, the following safety practices

and procedures need to be implemented and enforced at all construction projects. Ladders that project into passageways or doorways where they could be struck by personnel, moving equipment, or materials being handled must be secured to prevent accidental displacement or be protected by barricades. Workers should always face the ladder and use both hands when going up and down ladders. Materials and tools should be lowered or raised by a rope or other mechanical means. Hold on to the railing on stairways. The areas around the top and base of ladders must be free of tripping hazards such as loose materials, trash, and electrical cords. The same holds true for the bottom of stairways and on stairway platforms.

**Ladders** - Ladders must be capable of supporting four times the maximum intended load. Ladder rungs, cleats, and steps must be parallel, level, and uniformly spaced (not less than 10" nor more than 14"). Do not tie or fasten ladders together to provide longer sections unless they are specifically designed for such use. All stepladders must be equipped with a metal spreader or locking device. Do not paint wooden ladders, except to stencil for identification. Maintain ladders free from oil, grease, and other slipping hazards. Ladders must extend at least 3 feet above the upper landing surface and be secured. The horizontal distance for the base of the ladder should extend 1 foot for every 4 feet in vertical distance. Wood job-made ladders must be used at an angle so that the horizontal distance is one-eighth the working length of the ladder. Do not use ladders on slippery surfaces unless they have been properly secured or provided with slip-resistant feet. Do not move, shift, or extend ladder while occupied. Never stand on the top step of a stepladder.

A competent person on a periodic basis and after any occurrence that could affect their performance must inspect ladders. Ladders with structural defects must be tagged with "Do Not Use" or similar language and withdrawn from service until repaired. Never use a metal ladder when working on electrical equipment or near electrical equipment where contact is possible. Any employee who uses a ladder or stairway must receive training by a **competent person** in the following areas:

- Types of fall hazards.
- Correct procedures for erecting, securing, maintaining, and disassembling fall protection systems.
- Proper construction (man-made), use, placement, and handling.
- Maximum intended load-carrying capacities.
- Requirements contained within 29 CFR 1926 Subpart X.

**Stairways** - Stairways that are not permanent parts of the structure must have landings of not less than 30 inches in the direction of travel. A platform must be provided where doors or gates open directly on a stairway. Metal pan landings and metal pan treads must be filled in with wood or other materials if they are to be used prior to being finished. Maintain all parts of stairways free from hazardous projections, such as protruding nails. Eliminate slippery conditions on stairways before the stairways are used to reach other levels. Every flight of stairs with four or more risers or rising more than 30 inches must have standard stair railings or standard handrails.

## **9.15 Materials Handling, Storage, Use, and Disposal**

### *Applicable Standards:*

*OSHA 29 CFR 1926.250 through 252*

*USACE EM 385-1-1 Section 14 – Material Handling, Storage, Use and Disposal*

In the handling of materials, employees must know the following: There must be safe clearance for equipment through aisles and doorways. Vehicles must be shut off and brakes must be set prior to loading or unloading. Containers of combustibles or flammables, when stacked while being moved, must be separated by dunnage sufficient to provide stability. Trucks and trailers will be secured from movement during loading and unloading operations. Hand trucks must be maintained in safe operating condition. Chutes must be equipped with sideboards of sufficient height to prevent the handled materials from falling off. At the delivery end of rollers or chutes, provisions must be made to brake the movement of the handled materials. Hooks with safety latches or other arrangements will be used when hoisting materials, so that slings or load attachments won't accidentally slip off the hoist hooks. Securing chains, ropes, chokers, or slings must be adequate for the job to be performed. When hoisting material or equipment, provisions must be made to assure no one will be passing under the suspended loads.

Stack, rack, block, interlock, or otherwise secure all materials and supplies to prevent sliding, falling, or collapse. Post the maximum safe load limits for floors within buildings and structures in a conspicuous location. Never exceed the maximum safe load limit. Keep aisles and passageways clear to provide for the free and safe movement of material handling equipment and employees. Use ramps, blocking, or grading when a difference in road or working levels exists to ensure the safe movement of vehicles between the two levels. Do not place material within 6-feet of any hoistway or floor opening inside buildings under construction, nor within 10-feet of an exterior wall that does not extend above the material being stored. Stack bagged materials by stepping back the layers and cross-keying the bags at least every 10 bags high. Do not store materials on scaffolds or runways in excess of supplies needed for immediate operations. Remove all nails from used lumber prior to stacking. Stack lumber on level and solidly supported sills. Do not stack lumber higher than 20-feet (16-feet if handled manually).

Stack and block structural steel, poles, pipe, bar stock, and other cylindrical materials, unless racked, so as to prevent spreading or tilting. Attach handles or holders to the load to reduce the possibility of pinching or smashing fingers. Unload materials close to the point of final use to avoid unnecessary lifting. Do not stack non-compatible materials in the same pile.

***Manual Materials Handling*** - Employees working alone should not attempt to lift or move a load that is too heavy for one person - get help! When working with materials stored in silos, hoppers, tanks, or similar storage areas, be aware that confined spaces may exist. Attach handles or holders to the load to reduce the possibility of pinching or smashing fingers. Wear protective gloves and clothing (i.e., aprons), if necessary, when handling loads with sharp or rough edges. When pulling or prying objects, workers should be properly positioned. Riding loads, slings, the ball, crane hook, or other material hoisting equipment is prohibited.

***Engineering Controls*** - Engineering controls should be used, if feasible, to redesign the job so that the lifting task becomes less hazardous. This includes reducing the size or weight of the object lifted, changing the height of a pallet or shelf, or installing a mechanical lifting aid

OSHA standard 1926.251 provides guidance about the limitations and uses of slings used in conjunction with other material handling equipment for the movement of material by hoisting. Slings covered by this standard include those made of alloy steel chain, wire rope, metal mesh, natural or synthetic fiber rope, and synthetic web (nylon, polyester, and polypropylene). Some general work practices related to rigging include:

- Rigging equipment must be inspected prior to use on each shift and during its use to ensure that it is safe. Defective rigging equipment will be removed from service. A rigging inspection matrix form is located in Appendix C.
- Rigging equipment must not be loaded in excess of its recommended safe working load. The standard provides load capacity tables for various types of slings and associated hardware.
- Rigging equipment, when not in use, must be removed from the immediate work area.

In addition to these general guidelines, the standard has specific requirements related to alloy steel chains, wire rope, natural and synthetic rope, and synthetic webbing. Employees performing rigging work should be adequately trained in the safety and functional aspects of rigging for materials handling operations.

## **9.16 Signs, Signals, and Barricades**

### *Applicable Standards:*

*OSHA 29 CFR 1026.200 – 203*

*DOT Manual on Uniform Traffic Control Devices (MUTCD)*

*USACE EM 385-1-1 Section 8 - Accident Prevention Signs, Tags, Labels & Signals*

The use of signs, signals, and barricades is essential to make employees aware that an immediate or potential hazard exists. The following sections discuss the primary ways that employees are made aware of hazards in their work areas.

***Accident Prevention Signs/Tags*** - Signs, signals, regulated areas, and barricades must be used on each construction project as appropriate.

***Danger Signs*** are used wherever an immediate hazard (i.e., exposed electrical conductor) exists. The danger signs must have red as the predominant color in the upper panel and a white lower panel for additional sign wording.

***Caution Signs*** are used to warn against potential hazards or to caution against unsafe practices. The caution signs must have yellow as the predominant color with a black upper panel (yellow lettering of "caution" on the upper panel) and a yellow lower panel for additional sign wording.

***Exit Signs***, when required, should be in legible red 3/4" (1.9 cm) stroke letters, not less than 6" (15.2 cm) high, on a white field.

*Safety Instruction Signs*, when used, must be white with a green upper panel and white lettering to convey the principal message. Any additional wording must be in black lettering on the white background.

*Directional Signals* must be white with a black panel and a white directional symbol. Any additional wording must be in black lettering on the white background.

*Traffic Signs* must be posted at points of hazards in all construction areas. All traffic control signs or devices must conform to the DOT MUTCD and ANSI D6.1-1971, *Manual on Uniform Traffic Control Devices for Streets and Highways*.

*Accident Prevention Tags* are used as a temporary means of warning employees of an existing hazard, such as defective tools, equipment, etc.

*Out of Order Tags* are used to designate equipment that requires repair or maintenance. Equipment with such a tag may not be used until the tag is removed.

**Signaling** - Flagmen or other appropriate traffic controls must be provided for operations where signs, signals, and barricades do not provide the necessary protection on or adjacent to a highway or street. Signaling directions must conform to DOT *Manual on Uniform Traffic Control Devices* (MUTCD) and ANSI D6.1-1971, *Manual on Uniform Traffic Control Devices for Streets and Highways*. Stop/Slow sign paddles must be used by flagmen when hand signaling. Red flags, at least 18 in<sup>2</sup>, may be temporarily used in traffic control. Flagmen are required to wear a high visibility green or orange reflective warning vest and a hard hat while flagging. Required signs and symbols must be visible at all times when work is being done, and removed or covered promptly when the hazard no longer exists.

**Cones, Barrels, Barricades, and Barriers** - Channeling devices such as cones, barrels, or barricades are required for jobsite roadways presenting a hazard to motorized equipment or vehicles. Barriers may also provide a greater degree of work zone protection. Consult traffic control resources such as the DOT MUTCD for guidance on establishing and working in road construction work zones.

## 9.17 Cranes and Hoists

### *Applicable Standards:*

OSHA 29 CFR 1926.550 - 556

USACE EM 385-1-1 Section 15 – Rigging, 16.C Cranes and Derricks

The target goal of a crane safety program is zero crane accidents. To achieve this goal, the following safe work procedures must be implemented and enforced at all company projects:

- Crane operators are required to comply with crane manufacturer's specifications and limitations applicable to the operation of any and all cranes, derricks, and hoists.
- Rated load limits and recommended operating speeds, special hazard warnings, or instructions must be posted on all equipment.

- Hand signals to crane and derrick operators must conform to the applicable ANSI standard for the type of crane being used.
- A **competent person** who is knowledgeable in proper crane setup and operation activities must inspect all machinery and equipment prior to each use, and during use, to ensure it is in safe operating condition.
- Any defective parts must be repaired or replaced before use.
- A **competent person** who is knowledgeable in crane inspection techniques must perform an annual inspection of the hoisting machinery and provide a copy of the dates and results of inspections for each hoisting machine and piece of equipment to the site superintendent.
- All moving parts or equipment (belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheel, etc.) must be guarded to prevent contact by employees.
- Accessible areas within the swing radius of the rotating superstructure of the crane must be barricaded to prevent an employee from being struck or crushed by the crane.
- Exhaust pipes must be guarded or insulated to prevent contact by employees.
- Windows in cabs must be of safety glass, or equivalent, that introduces no visible distortions.
- Where necessary, a ladder or steps must be provided to allow access to a cab roof.
- Platforms and walkways must have anti-skid surfaces.
- A fire extinguisher of 5ABC rating must be accessible at all operator stations or cabs of equipment. No part of a crane or load is permitted within 10 feet (3.0 m) of electric power lines, except where electrical distribution and transmission lines have been de-energized and visibly grounded. A person will be designated to observe clearance of the equipment and provide timely warning to the crane operator.
- No employee is permitted to work beneath a suspended load.

As part of a crane safety program, site superintendents will develop a working knowledge of the client's requirements for operating construction cranes, derricks, or hoists on project property. Interview prospective crane operators prior to site employment to ascertain competence and qualifications and check the prospective crane operator's past experience with previous employers, if possible. The Superintendent or his designee will conduct daily inspections to observe compliance with established company and client crane and rigging procedures and immediately shut down any crane operations that jeopardize the safety of any jobsite personnel.

### 9.18 Housekeeping

*Applicable Standard:*

29 CFR 1910.25

USACE EM 385-1-1 Section 14.C Housekeeping

A policy of trash removal and the maintenance of good housekeeping practices will be implemented. The accumulation of construction debris may pose a significant fire hazard in addition to tripping and falling hazards.

Good housekeeping practices are the result of planning and organization. All personnel on the site must work together to maintain a clean worksite. The prompt removal of waste materials will permit a free flow of traffic through the work areas. Daily, or more frequent, inspections will be conducted by the SSHO to verify that the housekeeping controls are in place and being enforced.

Housekeeping activities in themselves may pose health hazards such as exposures to dusts, biological agents, and discarded chemicals. Liquid and solid waste chemicals must be placed in leak-proof containers for proper disposal.

### **9.19 Hours of Service**

Operators of equipment, such as hoisting equipment, mobile construction equipment, electrical power systems, hydraulically operated equipment, shall not be permitted to exceed 12 hours of duty time in a 24-hour period, including time worked at another occupation. A minimum of 8 consecutive hours shall be provided for rest in each 24-hour period.

Operators of motor vehicles, while on duty, shall not operate vehicles for a continuous period of more than 10 hours in any 24-hour period; moreover, no employee, while on duty, may operate a motor vehicle after being on duty status for more than 12 hours during any 24-hour period. A minimum of 8 consecutive hours shall be provided for rest in each 24-hour period.

## **10.0 SITE CONTROL MEASURES**

This section outlines site control measures to be implemented to minimize potential exposure to and accidental spread of hazardous substances during remedial activities. Listed below are the work zones that will be established. The zone boundaries may be modified as necessary as new information becomes available.

### **10.1 Work Zones**

The Site will be divided into Exclusion, Contamination Reduction, and Support Zones. It should be recognized that the Site control zones will be modified continually. A map showing the work zones will be posted in the Site office. Refer to the *Temporary Facilities Plan* for zone locations. The SSHO will review the location of work zones at the daily safety briefing.

The SSHO and at least one person who has completed Supervisor's Training will be present at the Site whenever work is performed in the Exclusion Zone or Contamination Reduction Zone. Similarly, at least two First aid/CPR-trained individual will be present at the Site when work is performed in those zones.

#### **10.1.1 Exclusion Zone (EZ)**

The Exclusion Zone is where there will be direct contact with the potentially contaminated material. PPE will be required in this zone. The SSHO will enforce these requirements. The level of PPE required will be based on hazard, site condition and air monitoring performed. The outer boundary of

the Exclusion Zone will be delineated. Modification to the size and boundary of the Exclusion Zone will be made in the field by the SSHO based on operations and wind direction. The Exclusion Zone may be subdivided into different areas of contamination and different levels of PPE may be assigned based upon the expected type and degree of hazard.

All activities in exclusion zone will be conducted using the "buddy system". This involves a buddy who is able to provide his or her partner with assistance, observe for signs of chemical or heat exposure, check integrity of PPE and go for help when needed.

#### **10.1.2 Contamination Reduction Zone (CRZ)**

The Contamination Reduction Zone is where workers and equipment will be decontaminated. This will minimize the spread of contaminants from the Exclusion Zone into clean areas. The Contamination Reduction Zone will consist of the area located in front of or next to the exclusion zone so that personnel or equipment exiting the Exclusion Zone can be decontaminated and doff the PPE. Emergency equipment to be located in this area will include eye wash stations, fire extinguishers, first aid kits and other appropriate equipment. The Contamination Reduction Zones or personal decontamination stations will be established adjacent to the Exclusion Zones. These stations will provide a means for prompt removal of potentially contaminated outer PPE at a location convenient to operations.

#### **10.1.3 Support Zone**

The Support Zone is considered to be uncontaminated. This area will be used as a storage area for operations equipment and where break and toilet and shower facilities will be located.

### **10.2 Site Entry and Exit Control Log**

All site personnel on this project will undergo safety orientation by the SSHO prior to starting work at the site. This training will include general site safety rules, hazardous locations, personal protective equipment guidelines, and onsite emergency procedures. All site personnel will satisfy the following requirements before initiating work onsite within the Exclusion or Contamination Reduction Zones:

- Receive and pass a physical examination, including certification of ability to wear respiratory protection.
- Receive adequate hazardous waste training according to 29 CFR 1910.120 or 29 CFR 1926.65.
- Receive a briefing on all aspects of the SSHP.
- Are properly dressed, equipped, and trained in accordance with all personal protective guidelines.
- Are thoroughly trained regarding decontamination procedures.
- All personnel performing tasks when respiratory protection is needed will comply with the requirements of this plan

All personnel entering and exiting the Exclusion and Contamination Reduction Zones will sign in and out through the Support Zone. The log will indicate the date and time entering and exiting, the location entered, personal protective equipment utilized and decontamination procedures.

## **11.0 PERSONAL HYGIENE AND DECONTAMINATION**

Decontamination (Decon) is the process of removing or neutralizing potentially harmful contaminants that have accumulated on personnel and equipment in order to reduce the spread of contamination outside the work area. Decontamination is critical to the Safety and Health of Site workers and it protects the community by minimizing the off-site migration of contaminants. One of the most important aspects of controlling contaminated material migration is the prevention of the spread of contamination. Good contamination prevention will minimize employee and public exposure.

All personnel and equipment leaving the Exclusion Zone must be decontaminated in the Contamination Reduction Zone prior to entering the Support Zone. The decontamination process is composed of a series of steps performed in a specific sequence. The basic concept is that more heavily contaminated items will be decontaminated and removed first, followed by decontamination and removal of inner, less contaminated items.

During remedial activities at the Site, all items taken into the Exclusion Zone must be considered contaminated and must be carefully inspected and/or decontaminated before leaving the Site. All contaminated vehicles, equipment and material will be cleaned and decontaminated to the satisfaction of the SSHO prior to leaving the Site. Decontamination procedures will be posted at every decontamination station throughout the project.

### **11.1 Personal Decontamination**

Personnel exiting the Exclusion Zone during remedial activities at the Site will follow the procedure below.

As the worker leaves the Exclusion Zone, he places his equipment and tools in the Exclusion Zone or Contamination Reduction Zone. After the worker places his equipment and tools down, gross contamination will be removed from outer clothing and boots. Workers will then remove their outer boots and outer gloves and place them in plastic garbage bag-lined containers.

Once outer gloves are removed, workers will remove all outer garments and place them in plastic garbage bag lined containers. Once workers are fully decontaminated and all garments are removed, workers will remove their respirators (applicable to Level C) followed by removal of inner gloves. Used cartridges and inner gloves will be placed into plastic garbage bags.

All decontamination stations will be established on (2) - 6 mil plastic sheets, covered with approximately 2 inches of stone. The stone will be replaced as often as is deemed appropriate.

The change trailer will be used by the on-site staff for short breaks during the workday. The trailer will have an area for changing, washbasins, and counters. This trailer is considered part of the Support Zone and cannot be entered from the Contamination Reduction Zone unless the individual has completed the outlined decontamination procedures. All equipment will be decontaminated before being brought into the trailer.

## **11.2 Respirator Decontamination**

Respirators are to be decontaminated, cleaned and sanitized before reuse. Cartridges and/or filters must be replaced as needed and, as a minimum, changed daily. The respirators are then cleaned with cleaning and sanitizing solutions, wiped dry and placed into sanitary containers or bags and sealed closed. Before departing the change locker facility, respirators are placed into storage compartments for next day use.

## **11.3 Equipment Decontamination**

Nearly all hardware (not consumable) is considered to be recoverable. As such, they will be decontaminated using the proper equipment, (i.e. brushes, sprayers, detergent and, if necessary, other appropriate solvents). Large heavy equipment will be decontaminated with pressure steam wash as required.

The decontamination area for vehicles and equipment leaving the Exclusion Zone will be located within the Contamination Reduction Zone. Equipment will be decontaminated over 2 layers of 6-mil plastic placed on the ground. Scrapers and brushes will be used to remove gross contamination prior to final decontamination. A pressure steam cleaner will be used for the final cleaning and decontamination of the equipment. The combination of dry removal with the brushes and use of the steam cleaner will minimize the generation of contaminated liquid. All solids and liquids will be collected for disposal. Efforts will be made to minimize soil (even non-contaminated soil) from being tracked off-site. Dirt and mud will be removed from trucks and vehicles leaving the Site to the extent practicable.

## **11.4 Decontamination Log**

A decontamination log will be maintained and will list the equipment name and model number, the equipment I.D. number, the activities the equipment was used for, the method of decontamination, amount of decontamination, date and time of decontamination and names of personnel doing the decontamination. This log will be maintained by the SSHO and included in the Safety and Health Report.

## **11.5 Decontamination Residue**

Decontamination residue consists of disposable PPE (such as Tyvek, gloves, tape and cartridges) and settled solids. Decontamination residue will be drummed and stored in the Exclusion Zone until subsequent treatment or disposal.

## **11.6 Personal Hygiene and Sanitation**

Hands and face will be thoroughly washed before eating, smoking, drinking, chewing gum or tobacco.

When possible, avoid contact with contaminated materials.

Support facilities such as wash facilities, eating areas, changing areas, and portable toilets will be located in the Support Zone. This area will remain "clean" and free of contamination.

An adequate supply of potable water will be provided to the employees working at the Site. Clearly labeled potable containers will be used to dispense drinking water. Containers will be cleaned at the beginning of each day. The containers will be equipped with taps to access the water. Clean disposable cups will be provided daily.

Portable toilet facilities will be provided on-site for employees and will be located in the Support Zone.

Eating, drinking, smoking, chewing gum or tobacco, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited during remedial activities except in designated eating or smoking areas outside the Exclusion and Contaminant Reduction Zones. Severson employees, subcontractor employees, and service personnel are required to thoroughly decontaminate themselves prior to entering the Support Zone.

## **12.0 EMERGENCY CONTINGENCY PLAN**

This section describes the emergency response plan that will be implemented by Severson to handle emergencies. The nature of the project, the contaminants present and the activities planned for the site are such that there is little potential for an emergency, which would result in a significant release of hazardous substances, and in any way threaten the adjoining community. There is always the potential at any site for emergency situations to occur which threaten the on-site workers. Possible examples of emergency situations during remedial activities include equipment fires or worker injury. In all of these cases, procedures will be implemented to minimize the possibility of an emergency situation. The procedures outlined below are designed to ensure that the workforce reacts quickly and appropriately to emergency situations, thereby protecting the health and well being of the individual workers. It is expected that modifications may be necessary upon actual site set-up and conditions.

NOTE: In the event of a serious or life threatening emergency the primary consideration is the immediate health of the individual rather than routine contamination controls. Standard contamination control protocols shall not interfere with the prompt medical attention required of a seriously injured worker.

### **12.1 Pre-Emergency Planning**

During the site safety briefings held daily, all employees will be informed of the location of this plan, the procedures outlined in this plan, and the communication systems and evacuation routes to be used during an emergency.

On a continual basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency.

A coordination meeting with local emergency response agencies (fire, police, rescue and medical facility) will be conducted prior to work starting at the site. The site activities and potential hazards that may be encountered by responders will be reviewed during this meeting.

## **12.2 Personnel Responsibilities**

All on-site employees have a role in mitigating an emergency incident. The Project Superintendent has primary responsibility for responding to and directing emergency response operations to correct emergency situations. This includes taking appropriate measures to ensure the safety of site personnel and the public. He is additionally responsible for ensuring that corrective measures have been implemented, appropriate authorities notified, and follow-up reports completed. The SSHO will assist and advise the Project Superintendent, and will direct any emergency medical responses.

The following is an outline of job titles and corresponding responsibilities during an emergency.

- The Site Superintendent directs emergency response activities and serves as liaison with appropriate Client and Client representative's personnel, subcontractors and tenants at the industrial park. In the event of an emergency the Project Superintendent will be the Incident Commander.
- The SSHO recommends that work be stopped if any operation threatens worker or public health or safety and advises Site Superintendent of emergency procedures. The SSHO will assume the responsibility of Incident Commander if the Project Superintendent is off-site.

## **12.3 Evacuation Routes and Procedures**

In the event of an emergency that necessitates an evacuation of the site, on-site personnel will be notified by hand-held or mobile two-way radios to leave the area by immediate emergency exit. An alternate method of communication will be the use of a portable air horn sounded in regularly spaced, repeated blasts. The Site Superintendent or his designee will notify the appropriate responding agencies.

During an evacuation, all non-emergency radio transmissions will cease. The SSHO, in conjunction with the Project Superintendent, will control the scene until the appropriate municipal and state agencies arrive and a site specific Incident Command System should be implemented. Since site conditions, (i.e., wind direction, precipitation, and work location), change often, the SSHO will determine the appropriate evacuation procedures.

All personnel will assemble/muster at the Safety and Health trailer unless otherwise directed by the Site Superintendent or SSHO. Access to the site will be restricted.

## **12.4 Emergency Decontamination Procedures**

Decontamination of an injured or exposed worker will be performed if decontamination does not interfere with essential treatment. The objective is to successfully administer first aid without exposing rescue workers and the victim to contaminants. Project personnel will meet with the local hospital to discuss the possibility of having to treat injured personnel from the site.

If the hazards are low and decontamination can be performed, then a wash, rinse and removal of protective clothing will be performed.

If the hazards are high and decontamination cannot be done, then the following procedures will be performed:

- Wrap the victim in blankets or plastic sheeting to reduce contamination of rescue workers or other personnel.
- Alert emergency and medical personnel to potential contamination. Emergency entry into the exclusion zone will be controlled by the SSHO. The SSHO will determine if the victim can be moved from the exclusion zone. If entrance into the exclusion zone is required, the SSHO will ensure that the emergency workers don the proper PPE.
- The SSHO will accompany the victim to the hospital.

## 12.5 Medical Treatment/First Aid

The SSHO will be trained in CPR and First Aid and have first aid kits for use in a medical emergency. First Aid Kits will be located in the main support area, Contamination Reduction Zone and at the work activity locations. Eyewash stations will be available at the Contamination Reduction Zone. Eyewash stations will be of the pressurized, 15-minute discharge type. On-site employees have a basic knowledge of first aid and will assist the Site Superintendent and SSHO. Community emergency services (EMS, Fire, and Police) will be notified immediately if their resources are needed on site.

If necessary, the injured or sick party will be taken to John F. Kennedy Medical Center— Please refer to *Figure 3 – “Route to Hospital Map”*, for directions to the area hospital. Route to the area hospital will be posted and easily visible at all times.

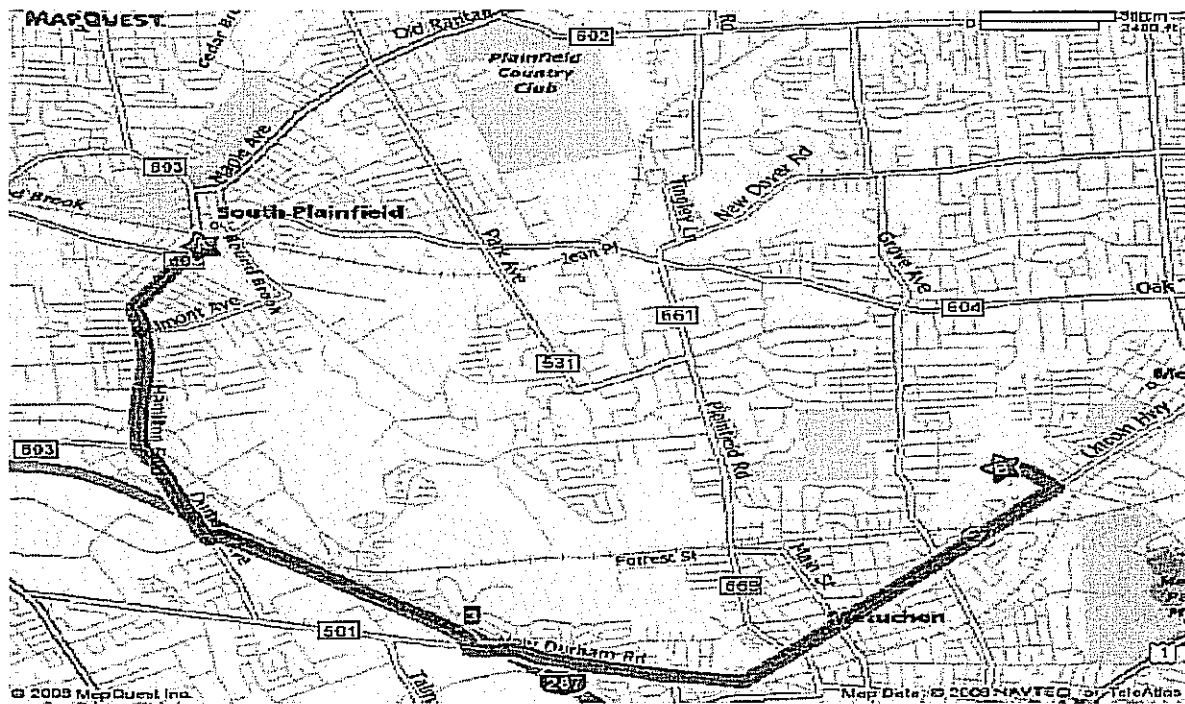
## 12.6 Emergency Alarms/Notifications and Procedures

When any emergency occurs on-site the SSHO and Project Superintendent will be notified immediately. The Project Superintendent or the SSHO will notify the client and his representatives. Please refer to the *Table 9 – “Emergency Telephone Numbers”* for emergency telephone numbers. Emergency Telephone numbers will be posted and easily visible at all times.

All emergency communications will flow through the radio network. Outside emergency services will be notified, as necessary. The site evacuation alarm consists of one long blast on a horn, every 10 seconds. Any time the alarm system is activated, on site personnel will be notified immediately. Personnel will extinguish any nearby ignition source and prepare for emergency response activities. This alarm will also be used to alert personnel of a sudden release of hazardous materials.

The observer of the emergency condition will brief the responding personnel as to the nature and location of the incident. When they have assessed the situation, a decision whether or not to implement these procedures will be made. If these Emergency Contingency Procedures are not implemented, the "All Clear" will be given verbally by supervisory personnel. The "All Clear" will be used to indicate a return to normal (non-emergency) conditions following emergency response activities. The alarm signals will be prominently posted at the site. The audible alarm system will be discussed with each resident within hearing range of the alarm system.

**Figure 3 - Route to Hospital Map**



**Direction to John F. Kennedy Medical Center – 732-321-7070**

**Depart Site on Hamilton Boulevard (South-West)**  
 Bear **LEFT** (South) onto CR-603 (Hamilton Boulevard)  
 Turn **RIGHT** to stay on CR-603 (Hamilton Boulevard)  
 Stay **STRAIGHT** to go onto Durham Ave  
 Take Ramp (**LEFT**) onto I-287 South  
 Take Exit 3 CR-501 E toward Metuchen  
 Turn **LEFT** onto New Durham Rd/CR-501  
 Continue to follow CR-501  
 Stay **Straight** to go onto NJ-27/Middlesex Ave  
 Continue to follow NJ-27  
 Turn **LEFT** onto James Street  
**Arrive at JFK Medical Center (hospital), Edison, New Jersey**  
**Distance: 6.53 Miles / Time: 16 Minutes**

Table 9– Emergency Telephone List	
South Plainfield Police Department	908-226-7678; 911
South Plainfield Fire Department Chief	908-769-9817; 911
Middlesex County HAZMAT Team	732-727-6626; 911
Sewage	856-456-0169
Hospital – JFK Medical Center	732-321-7070
Dr. Greaney – Occupational Specialist (Work Care)	714-456-2154
<b>Sevenson Environmental Services, Inc.</b>	
Richard Elia – Program Manager V.P. Sevenson	716-284-0431
Paul J. Hitcho, PhD, CIH - Safety and Health Manager	716-284-0431(work)/716-998-9797(cell)
Alfred LaGreca - Corporate Project Manager	716-284-0431(work)/716-807-4147(cell)
Kim Lickfield – Project Manager	716-284-0431(work) / 908-769-5301 (site)
Perry Novak - Project Superintendent	908-769-5301
Eric Tschudi–Safety and Health Officer	908-769-5301(work) / 772-475-6821 (cell)
TBD- Alternate Safety and Health Officer	908-796-5301(work) / TBD (cell)
William Zambrana– Project QA/QC officer	908-769-5301
<b>US Army Corps of Engineers</b>	
Neal Kolb- Resident Engineer	732-846-5830
Patrick Nejand - Contracting Officer Representative	908-769-1601
<b>Other Numbers</b>	
New Jersey One Call (Dig Safely)	800-272-1000
NJDEP 24-Hour Hot Line	877-WARNDEP (877-927-6337)
National Response Center	800-424-8802
CHEMTREC	800-424-9300

## 12.7 Implementation of the Plan

There is a logical sequence of steps to follow in responding to emergencies, which should be followed by site personnel. This sequence involves identifying the emergency, investigating the extent of the emergency, deciding on the proper initial course of action, taking corrective action to rectify the situation, and following up with a post-emergency investigation.

Equipment breakdowns, power failures, injuries, and natural disasters are usually rather dramatic and will capture the individual's attention immediately upon occurrence. In other cases, the individual may have prior warning of impending emergencies through weather reports in the case of natural disasters and trends in equipment performance in the case of some breakdowns.

In the event of a fire, explosion, accidental material release, or any other emergency, response activities will be initiated following the evaluation of the event. An assessment of the situation will be performed by the SSHO immediately upon notification. The Superintendent or SSHO is authorized to commit resources to the extent detailed in this plan. If it is determined that an emergency situation exists, he will then implement the appropriate emergency response activities.

In the event that a medical emergency or accident occurs in the Exclusion Zone, all personnel responding to the emergency shall be outfitted in the Personal Protective Equipment appropriate for the situation. As a general rule, personnel shall not enter the Exclusion Zone without donning the minimal level of PPE required. In the event that a worker is overcome or disabled for an unknown

reason, the SSHO must make a determination as to the appropriate level of respiratory protection. Specifically, a determination must be made as to whether Supplied Air Respirators are necessary for the protection of the responders.

#### **12.7.1 Conditions for Implementation**

The contingency plan will be activated by the Superintendent or SSHO immediately in the event of a fire or explosion, or emissions of toxic chemicals in excess of limits set forth by Federal, State, and local agencies. In the event of a spill or material release, it will be up to the Superintendent or SSHO to make a determination as to when emergency conditions exist, as opposed to routine maintenance of the site. His determination will depend upon the location of the spill, the size of the spill, weather conditions and the proximity of the release to workers, the community and environmental receptors.

Once it becomes apparent that an emergency situation exists or that a disaster is impending, the Project Superintendent or SSHO shall conduct an assessment. Assessment of the emergency should include assessing the severity of the situation and collecting enough information to make an initial action decision.

Assessing the emergency should include identifying injured persons (if any), damage to buildings and equipment, noting potential impending damage if corrective action is not taken immediately, and itemizing resources required to correct the situation.

##### **12.7.1.1 Fire or Explosion**

The potential for fire or explosion does exist. These sources include welding gases, gasoline for portable equipment, diesel fuel for the heavy equipment, fuel for the LTTD burner, and combustible debris. In the event of an explosion, possible emergency conditions would exist. Unless extinguished immediately, a fire or explosion will trigger implementation of the emergency procedures.

##### **12.7.1.2 Material Spills**

Material spills can occur during truck loading and from vehicle accidents. Additionally, equipment fueling operations can produce spills. Ultimately, a spill can contaminate receiving surface water or cause a release of vapors to the air. A spill of fuel can also ignite. A small spill shall be cleaned up immediately, but should not trigger activation of these emergency procedures. Should an on site spill occur, the immediate response will include closing off the source of the spill, if possible, application of the sorbent material or sand bagging, and street sweeping, as appropriate. Any spill that results in a discharge to off site surface water will be contained with sorbent booms as needed. All spills will be investigated, and a written report will be provided to the regulatory agencies in accordance with applicable regulations.

##### **12.7.1.3 Severe Weather**

In the event of severe weather, the Site Superintendent and/or the SSHO have the authority to stop operations and direct evacuation procedures. All equipment will be secured and grounded. After the storm, a visual inspection will be performed by the Superintendent and/or the SSHO to check for damage and hazards. These will be performed before any work is resumed. If damage or hazards are noted, Severson personnel will evaluate the conditions and implement corrective actions to repair the

damage or eliminate the hazard. These actions will begin as soon as possible and will take precedence over other Site activities.

Severe weather will be monitored using a weather station that is part of the National Oceanic and Atmospheric Administration (NOAA) at the Site via the Internet.

A Spectrum Electronics Thunderbolt<sup>1</sup> lightning detection instrument (or equivalent) will monitor for weather conditions that may cause lightning at the Site. This instrument has the capability to detect conditions that may produce lightning from as far as 75 miles away. The instrument will continually update the distance of the storm from the Site and will provide a warning (settings include; when the storm is local (within 8 miles) from the Site as well as the time (in minutes) until the storm has cleared the Site.

The following controls will be implemented for severe weather:

- When the storm is within 20 miles of the Site all Site personnel will be notified that severe weather is approaching. Any work being performed above ground level will be stopped. Employees will take precautions to secure items that could become airborne from high winds at this time.
- When the storm becomes localized (within 8 miles of the Site) all work will be stopped, equipment secured, and workers will make their way to a designated shelter area.
- Work will not resume until the storm has cleared the Site for a minimum of 30 minutes.

The SSHO with the approval by the Contracting Officer's Representative will designate acceptable shelter areas and will post a map of these areas on the Job Site Bulletin Board.

#### **12.7.2 Initial Action**

Once the extent of the emergency is known, the Superintendent and the SSHO will make an immediate decision as to what initial steps should be taken to remedy the emergency situation. This first action, in the case of large-scale emergencies, usually consists of notifying responsible authorities and/or calling for the necessary assistance in order of priority.

The individual(s) should not unduly endanger him or herself or others by attempting tasks for which the proper equipment is not available or with which he or she is unfamiliar. In all cases, if in doubt, wait until qualified help arrives before taking action.

#### **12.7.3 Corrective Action**

When help arrives, the Site Superintendent or SSHO shall immediately inform those called of the pertinent details of the situation. Corrective action shall be continued until the situation is either under control or completely rectified. If corrective actions will take considerable time, a long-term effort to complete the task should be developed.

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<sup>1</sup> <http://www.spectrumthunderbolt.com/>

#### **12.7.4 Follow-through**

After the situation is corrected, the cause of the emergency event is to be determined and review of the corrective actions taken, etc. In the case of equipment failure, if negligence was not a factor, then revising maintenance procedures would be the most likely first preventive step. For natural disasters that cannot be prevented from recurring, the procedures followed in dealing with them can be reviewed to develop more effective action plans. The entire event, along with all of the responses, will be thoroughly documented for review by management and project supervisory personnel.

#### **12.8 Spill Response and Control Plan**

The purpose of this section is to define practices and procedures for the prevention, containment, and cleanup of accidental discharges of hazardous substances during the project. This section will compliment the Spill Control Plan; refer to the Remedial Action Work Plan, Appendix C. These substances include both the contaminated material managed as a result of the remedial project, such as contaminated soils and decontamination liquids, and construction materials typically found on any construction site, such as lubricating fluids, diesel fuel, gasoline, etc.

Spill prevention applies to all types of spills and can be described as the first and simplest approach to spill control. Human error is a major contributing factor to spills and releases. An awareness of spill consequences, preventive measures, and countermeasures will greatly reduce spill occurrences. A sound prevention program includes careful work practices, constant inspection, and immediate notification and correction of deficiencies. In the event that a spill does occur, proper containment and cleanup procedures must then be followed in order to reduce the effect of the spill.

##### **12.8.1 Prevention**

Prevention of unnecessary spills is of first priority. Prevention measures include:

- Operators and drivers will exercise extreme caution when transporting material around the site.
- When removing hoses from machines an appropriate and adequate supply of absorbents will be on hand. A supply of the following absorbents will be kept on-site, oil sorbent booms, rolls and pillows, universal towels and sheets, and vermiculite.
- Hoses will be capped when not connected to their appropriate fitting.
- All containers will be inspected daily for decay. No open container will be exposed to rainfall, snowfall, etc. without being emptied and cleaned of residue.
- All equipment will be inspected for leaks before and after service.
- Storage of material such as fuels, oils, and solvents on-site will be limited to the minimum required. All fluids will be stored in individual fluid containers appropriate and approved for the material. Most of the individual fluids containers will be further secured by storage in large, locked tool and equipment storage containers. Drums or other containers too large to be stored in containers will be stored raised off the ground on a liner and covered by plastic.

### 12.8.2 Reporting

All spills will be reported immediately to appropriate field and office management personnel. The sequence of reporting will be as follows:

- Notification by workers to the Project Superintendent or SSHO.
- The Project Superintendent or SSHO will immediately notify the Contracting Officer Representative regardless of the size of the spill.
- Severson and the Contracting Officer Representative will jointly determine the nature of the spill, its size, direction of travel, if anyone has been injured as a result of the spill and whether it requires immediate notification to regulatory agencies.
- The Contracting Officer Representative will have primary responsibility for notifying the regulatory agencies. Severson will have follow-up responsibility to verify that the notification is made in a timely manner. A full list of emergency contacts and telephone numbers is included in this plan. This list includes Severson personnel, as well as federal, state and local authorities. This list will be posted in all trailers on-site.
- The NJDEP will be notified by Contracting Officer Representative or the SSHO of all spills (regardless of their size); notification will be made to the NJDEP Hot Line.

Upon notification of a spill, all project activity will be immediately suspended and all necessary equipment and personnel will be diverted to spill control and containment. In the event of a spill, and regardless of the size, a Spill Incident Report will be submitted to the Contracting Officer Representative with a copy to the USEPA within 48 hours of the incident.

### 12.8.3 Spill Response Equipment

Given the nature of this project, all the necessary equipment and personnel necessary to deal with a release of hazardous substances will be available on site. In addition to the heavy equipment and personal protective equipment, which is critical to spill control, Severson will have on hand an ample amount of sorbent materials, UN1A2 open top drums and overpacks.

### 12.8.4 Confinement and Containment

Prior to entering a spill area, all workers must be protected from any adverse effects of the spilled material. No one will enter any spill area alone. The SSHO will determine the level of protection required for response activities. To the extent practicable, the area will immediately be cordoned off and, if appropriate, exclusion, contamination reduction, and support zones will be established.

The decision to use confinement techniques such as diversion, diking and retention, are generally based on time, personnel, equipment, and supplies. As mentioned above, all necessary resources will be available on-site at all times. To the extent the nature of the material is known, the decision shall be made based upon a review of the harmful effects of the material. In the event of a large migrating spill, an unlikely circumstance, diversion techniques, such as placing a soil wall or absorbent boom ahead of the spill, will be implemented first. Subsequently, diking techniques, such as using material such as sand covered with liner material (PVC, hypalon) shall be implemented.

### 12.8.5 Cleanup

Once a spill has been contained and the source of the spill corrected and controlled, cleanup can begin. Spill cleanup can proceed at the same time as containment, if feasible. Supervisory personnel will determine the appropriate cleanup methods. The SSHO will determine the appropriate level of protection depending upon the nature of the material.

- The first action will be to absorb free liquids with absorbent pads, booms, pillows, or clay. The absorbent material will be placed in drums and moved to an appropriate storage location. Subsequent to the removal of free liquids, soil believed to be contaminated will be excavated and containerized in drums or stockpiled on poly sheeting and covered for further testing.
- Dry spills, while posing less of a risk of migration, will still require appropriate and immediate action. The nature of the spilled material will be ascertained. The spilled material will be recovered for reuse if appropriate. Material which cannot be recovered, and residual contaminated soil will be shoveled into 55-gallon drums, placed in the drum storage area, and sampled and analyzed for waste characterization and disposal.
- Once containerized, Severson Environmental will provide for the appropriate sampling and analysis for waste characterization and disposal facility acceptance. Results of waste characterization analysis, waste profiles, and manifests will be provided to the Construction Representative for review.
- All spilled material and visually contaminated soil will be excavated and containerized in the initial spill response. If there appears to be a possibility that contaminants have migrated into the surrounding soil, post-remedial sampling will be initiated. Soil samples will be taken from the areas of suspected contamination and analyzed for the compounds, which were released.
- NJDEP requires the immediate notification for spills (regardless of their size) to the NJDEP Hot Line.

Personnel Decontamination - In general, all spill response operations will be performed in accordance with the provisions of the approved SSHP.

### 12.9 Report/Review

An immediate verbal notification will be given to the appropriate government agencies (EPA, NJDEP, Coast Guard) and the COR with a written report to follow within 24 hours of the incident resolution. The Contracting Officer Representative will be provided with a copy. In addition, all key personnel will have a meeting within 48 hours of the incident to discuss and critique all of the aspects of the Emergency Contingency Plan according to new site conditions and lessons learned.

## *Appendix C*

### *Chemical Information Sheets*

\* \* \* \* \*  
\* C H E M I N F O \*  
\*  
\* Canadian Centre for Occupational Health and Safety \*  
\* \* \* \* \* Issue : 2004-2 (May, 2004) \*

\*\*\* SECTION 1. CHEMICAL IDENTIFICATION \*\*\*

CHEMINFO RECORD NUMBER : 3362  
CCOHS CHEMICAL NAME : Chlorodiphenyl (54% chlorine)  
SYNONYMS :  
\* Aroclor 1254  
\* Polychlorinated biphenyl 1254  
\* PCB 1254  
CHEMICAL NAME FRENCH : Biphényles polychlorés (54 % Cl)  
Biphényle polychloré (54% Cl)  
CHEMICAL NAME SPANISH : Clorodifenilo (54% de cloro)  
CAS REGISTRY NUMBER : 11097-69-1  
UN/NA NUMBER(S) : 2315  
RTECS NUMBER(S) : TQ3600000  
EU EINECS/ELINCS NUMBER : 215-648-1  
CHEMICAL FAMILY : Halogenated aromatic hydrocarbon /  
halogenated biphenyl / halobiphenyl /  
chlorobiphenyl / monochlorobiphenyl  
MOLECULAR FORMULA : C12 H6 Cl4; C12 H5 Cl5; C12 H4 Cl6; C12 H3  
Cl2

STATUS :

This CHEMINFO record for this chemical is not complete. It only  
contains readily available information at this time.

\*\*\* SECTION 2. DESCRIPTION \*\*\*

APPEARANCE AND ODOUR :

Colourless to pale-yellow, viscous liquid (or solid below 10 deg C) with  
a mild hydrocarbon odour (1)

ODOUR THRESHOLD :

Not available

\*\*\* SECTION 3. HAZARDS IDENTIFICATION \*\*\*

\*\* POTENTIAL HEALTH EFFECTS \*\*

CARCINOGENICITY :

The International Agency for Research on Cancer (IARC) has concluded  
that this chemical is probably carcinogenic to humans (Group 2A).  
The American Conference of Governmental Industrial Hygienists (ACGIH)  
has designated this chemical as an animal carcinogen (A3).  
The US National Toxicology Program (NTP) has listed this chemical as  
reasonably anticipated to be a human carcinogen.

\*\*\* SECTION 5. FIRE FIGHTING MEASURES \*\*\*

FLASH POINT :

222 deg C (432 deg F) (closed cup) (2)

LOWER FLAMMABLE (EXPLOSIVE) LIMIT (LFL/LEL) :

Not available  
UPPER FLAMMABLE (EXPLOSIVE) LIMIT (UFL/UEL) :  
Not available  
AUTOIGNITION (IGNITION) TEMPERATURE :  
Not available  
COMBUSTION AND THERMAL DECOMPOSITION PRODUCTS :  
Exposure in fire results in the formation of a black soot containing  
PCBs, polychlorinated dibenzofurans and chlorinated dibenzo-p-dioxins (1)  
FIRE HAZARD SUMMARY :  
During a fire, toxic PCBs, polychlorinated dibenzofurans, chlorinated  
dibenzo-p-dioxins may be generated.  
EXTINGUISHING MEDIA :  
Dry chemical, carbon dioxide, water spray, or foam (3)

\*\* NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD IDENTIFICATION\*\*

NFPA - COMMENTS :  
NFPA has no listing for this chemical in Codes 49 or 325.

\*\*\* SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION \*\*\*

NOTE : Exposure to this material can be controlled in many  
ways. The measures appropriate for a particular  
worksite depend on how this material is used and on  
the extent of exposure. This general information can  
be used to help develop specific control measures.  
Ensure that control systems are properly designed and  
maintained. Comply with occupational, environmental,  
fire, and other applicable regulations.

SAMPLING AND ANALYSIS :

NIOSH METHOD 5503 - NIOSH Manual of Analytical Methods. 4th ed. Vol.  
3. Partially evaluated method for polychlorinated biphenyls. Collection  
on glass fibre membrane filter and florisil sorbent tube. Analysis by  
gas chromatography using electron capture detector (ECD). Estimated  
detection limited: 0.03 ug.  
Use appropriate instrumentation and sampling strategy (location, timing,  
duration, frequency, and number of samples). Interpretation of the  
sampling results is related to these variables and the analytical  
method. Sampling should be carried out by trained personnel.

PERSONAL PROTECTIVE EQUIPMENT :

If engineering controls and work practices are not effective in  
controlling exposure to this material, then wear suitable personal  
protection equipment including approved respiratory protection. Have  
appropriate equipment available for use in emergencies such as spills or  
fire.

If respiratory protection is required, institute a complete respiratory  
protection program including selection, fit testing, training,  
maintenance and inspection. Refer to the CSA Standard Z94.4-93,  
"Selection, Care, and Use of Respirators", available from the Canadian  
Standards Association, Rexdale, Ontario, M9W 1R3.

RESPIRATORY PROTECTION GUIDELINES :

NIOSH RECOMMENDATIONS FOR CHLORODIPHENYL (54% CHLORINE) CONCENTRATIONS  
IN AIR (1): AT CONCENTRATIONS ABOVE THE NIOSH REL, OR WHERE THERE IS NO  
REL, AT ANY DETECTABLE CONCENTRATION: Positive pressure, full-facepiece

SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

ESCAPE: Gas mask with organic vapour canister and high-efficiency particulate filter; or escape-type SCBA.

NOTE: The NIOSH Recommended Exposure Limit (REL) for chlorodiphenyl (54% chlorine) is 0.001 mg/m<sup>3</sup> time-weighted average concentration.

NOTE: NIOSH has classified this material as a potential occupational carcinogen, according to specific NIOSH criteria. This classification is reflected in these recommendations for respiratory protection, which specify that only the most reliable and protective respirators be worn. The requirements in Canadian jurisdictions may vary.

The respirator use limitations specified by the approving agency and the manufacturer must be observed.

Recommendations apply only to NIOSH approved respirators.

ABBREVIATIONS: SAR = supplied-air respirator; SCBA = self-contained breathing apparatus; IDLH = immediately dangerous to life or health.

RESISTANCE OF MATERIALS FOR PROTECTIVE CLOTHING :

No specific guidelines are available. Contact chemical manufacturer/supplier for advice.

\*\* EXPOSURE GUIDELINES \*\*

\* THRESHOLD LIMIT VALUES (TLVs) / AMERICAN CONFERENCE OF  
GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH) / 2003 \*

TIME-WEIGHTED AVERAGE (TLV-TWA) : 0.5 mg/m<sup>3</sup>, Skin - Carcinogenicity Designation A3

TLV BASIS - CRITICAL EFFECT(S) : Irritation  
Chloracne (acne caused by chlorine compounds)  
Liver

TLV DEFINITIONS :

CARCINOGENICITY DESIGNATION A3 - Animal Carcinogen: Substance is carcinogenic in laboratory animals under conditions that are not considered relevant to worker exposure. Available human studies and evidence suggest that the substance is not likely to cause cancer in humans except under unusual or unlikely routes or levels of exposure. Worker exposure to an A3 carcinogen should be controlled to levels as low as reasonably achievable below the TLV.

"SKIN" NOTATION: Contact with skin, eyes, and mucous membranes can contribute to the overall exposure and may invalidate the TLV. Consider measures to prevent absorption by these routes.

TLV COMMENTS :

NOTE: In many jurisdictions, exposure limits are similar to the ACGIH TLVs. Since the manner in which exposure limits are established, interpreted, and implemented can vary, obtain detailed information from the appropriate government agency in each jurisdiction.

\* PERMISSIBLE EXPOSURE LIMITS (PELs) / FINAL RULE LIMITS /  
US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) \*

TIME-WEIGHTED AVERAGE (PEL-TWA) : Not established

NOTE: The OSHA PEL Final Rule Limits are currently

non-enforceable due to a court decision. The OSHA  
PEL Transitional Limits are now in force.

\* PERMISSIBLE EXPOSURE LIMITS (PELs) / TRANSITIONAL LIMITS /  
US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) \*

TIME-WEIGHTED AVERAGE (PEL-TWA) : 0.5 mg/m3 - skin

TRANSITIONAL LIMIT PEL COMMENTS :

"SKIN" DESIGNATION: Skin contact can contribute to the overall exposure to this chemical. Prevent or reduce skin absorption through the use of gloves, coveralls, goggles or other appropriate personal protective equipment, engineering controls or work practices.

These Permissible Exposure Limits are taken from 29 CFR 1910.1000 Table Z - 1.

\*\*\* SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES \*\*\*

MOLECULAR WEIGHT : 326 (approximate)  
CONVERSION FACTOR :  
1 ppm = 13.31 mg/m3; 1 mg/m3 = 0.075 ppm at 25 deg C (calculated)  
MELTING POINT : 10 deg C (50 deg F) (1)  
BOILING POINT : 340 - 375 deg C (644-707 deg F) (2)  
RELATIVE DENSITY (SPECIFIC GRAVITY) :  
1.38 at 25 deg C (water=1) (1)  
SOLUBILITY IN WATER :  
Slightly soluble; 5-10 mg/100 mL at 23 deg C (2)  
SOLUBILITY IN OTHER LIQUIDS :  
Soluble in ethanol, acetone (2)  
COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT) :  
Log P(oct) = 6.30 (3)  
pH VALUE : Not available  
VAPOUR DENSITY : Not applicable  
VAPOUR PRESSURE : Approximately zero.  $8.0 \times 10^{-6}$  kPa ( $6.0 \times 10^{-5}$  mmHg) at 20 deg C (2)  
SATURATION VAPOUR CONCENTRATION : Not applicable  
CRITICAL TEMPERATURE : Not available

\*\*\* SECTION 10. STABILITY AND REACTIVITY \*\*\*

STABILITY :

Normally stable

HAZARDOUS POLYMERIZATION :

Does not occur

CONDITIONS TO AVOID :

Temperatures above 222 deg C

\*\*\* SECTION 12. ECOLOGICAL INFORMATION \*\*\*

NOTE : Inclusion of Ecological Information on an MSDS is optional under the US Hazard Communication Standard and the Canadian Controlled Products Regulations (WHMIS). In other jurisdictions, inclusion of Ecological Information may be a requirement. For specific requirements, contact the relevant regulatory authorities in the jurisdiction where the MSDS is intended to be used.

The American National Standard for Hazardous Industrial Chemicals - Material Safety Data Sheets - Preparation (ANSI 2400.1-1998) provides advice on data that could be included in this section, as well as ecotoxicological tests and issues.

Databases in CCOHS's CD-ROM and Web collection which contain useful Ecological Information include CESARS, HSDB(R) (Hazardous Substances Data Bank) and CHRIS (Chemical Hazards Response Information System).

\*\*\* SECTION 14. TRANSPORT INFORMATION \*\*\*

\*\* CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG)  
SHIPPING INFORMATION \*\*

SHIPPING NAME AND DESCRIPTION: ARTICLES CONTAINING POLYCHLORINATED BIPHENYLS (PCB) regulated only when the concentration is more than 50 ppm by mass; or  
POLYCHLORINATED BIPHENYLS (PCB) regulated only when the concentration is more than 50 ppm by mass  
UN NUMBER: UN2315  
CLASS: 9

PACKING GROUP/RISK GROUP: II  
SPECIAL PROVISIONS: ---  
PASSENGER CARRYING ROAD/RAIL LIMIT: 100 kg or L  
MARINE POLLUTANT: Severe Pollutant

NOTE: This information incorporates the Transportation of Dangerous Goods Regulations SOR/2001-286, effective October 1, 2003.

\*\* US DEPARTMENT OF TRANSPORT (DOT) HAZARDOUS  
MATERIALS SHIPPING INFORMATION (49 CFR) \*\*

HAZARDOUS MATERIAL DESCRIPTION AND PROPER SHIPPING NAME: POLYCHLORINATED BIPHENYLS, LIQUID  
HAZARD CLASS OR DIVISION: 9  
IDENTIFICATION NUMBER: UN2315  
PACKING GROUP: II

NOTE : This information was taken from the US Code of Federal Regulations Title 49 - Transportation and is effective October 2003.

\*\*\* SECTION 15. REGULATORY INFORMATION \*\*\*

\*\* CANADIAN WORKPLACE HAZARDOUS MATERIALS  
INFORMATION SYSTEM (WHMIS) \*\*

WHMIS INGREDIENT DISCLOSURE LIST :  
Included for disclosure at 0.1% or greater

\*\* EUROPEAN UNION (EU)  
CLASSIFICATION AND LABELLING INFORMATION \*\*

EU CLASSIFICATION :

Danger of cumulative effects; Dangerous for the Environment. [R:33;N]  
(5)

EU RISK PHRASES :

Danger of cumulative effects. Very toxic to aquatic organisms, may cause long term adverse effects in the aquatic environment. [R:33-50/53]

EU SAFETY PHRASES :

Keep out of reach of children.\* This material and its container must be disposed of in a safe way. This material and/or its container must be disposed of as hazardous waste. Avoid release to the environment.

Refer to special instructions/safety data sheet. [S:(2-)\*35-60-61]

\*This safety phrase can be omitted from the label when the substance or preparation is sold for industrial use only.

The product label must indicate if the substance is a specific isomer or a mixture of isomers.

EU COMMENTS :

CONCENTRATION GREATER THAN OR EQUAL TO 0.005%: Harmful. Danger of cumulative effects. [Xn;R:33]

\*\*\* SECTION 16. OTHER INFORMATION \*\*\*

SELECTED BIBLIOGRAPHY :

- (1) NIOSH pocket guide to chemical hazards. NIOSH, June 1994. p. 64
- (2) Compendium of safety data sheets for research and industrial chemicals. Part IV. VCH Publishers, 1985. p. 2044
- (3) HSDB record for aroclor 1254. Last updated 9501
- (4) Report on Carcinogens. 10th ed. US Department of Health and Human Services, National Toxicology Program, 2002
- (5) European Economic Community. Commission Directive 93/72/EEC. September 1, 1993
- (6) Forsberg, K., et al. Quick selection guide to chemical protective clothing. 4th ed. Van Nostrand Reinhold, 2002

Information on chemicals reviewed in the CHEMINFO database is drawn from a number of publicly available sources. A list of general references used to compile CHEMINFO records is available in the database Help.

REVIEW/PREPARATION DATE :

1995-12-27

REVISION INDICATORS :

TLV-TWA; 1996-09-01  
TLV comments; 1996-09-01  
US transport; 1998-03-01  
Resistance of materials; 1998-06-01  
TDG; 2002-05-29  
Carcinogenicity; 2002-12-19  
Bibliography; 2002-12-19  
PEL-TWA transitional; 2003-11-18  
PEL transitional comments; 2003-11-18  
PEL-TWA final; 2003-11-18  
PEL final comments; 2003-11-18  
Resistance of materials for PPE; 2004-04-08  
Bibliography; 2004-04-08

\*\*\* END OF RECORD \*\*\*

\* \* \* \* \*

\* C H E M I N F O \*

\* Canadian Centre for Occupational Health and Safety \*

\* \* \* \* \* Issue : 2002-3 (August, 2002) \*

\*\*\* SECTION 1. CHEMICAL IDENTIFICATION \*\*\*

CHEMINFO RECORD NUMBER : 608

CCOHS CHEMICAL NAME : Lead

SYNONYMS :

- \* Lead flake
- \* Lead metal
- \* Plumbum
- \* Elemental lead
- \* Plomb

CAS REGISTRY NUMBER : 7439-92-1

RTECS NUMBER(S) : OF7525000

CHEMICAL FAMILY : Lead and compounds / elemental lead / lead metal

MOLECULAR FORMULA : Pb

STRUCTURAL FORMULA : Pb

STATUS :

The CHEMINFO record for this chemical is complete. The full format ("TOTAL") provides a detailed evaluation of health, fire and reactivity hazards, as well as recommendations on topics such as handling and storage, personal protective equipment, accidental release and first aid.

\*\*\* SECTION 2. DESCRIPTION \*\*\*

APPEARANCE AND ODOUR :

A bluish-white, silvery, gray heavy, ductile, soft metal; tarnishes on exposure to air.(33,34)

ODOUR THRESHOLD :

Probably odourless.

WARNING PROPERTIES :

Information not available for evaluation

COMPOSITION/PURITY :

Commercial lead has a minimum purity of 99.85-99.985% and may contain bismuth, antimony, tin, arsenic, copper, iron, silver and zinc as impurities.(22) It is available as foil, ingot, rod, shot, wire and powder.

USES AND OCCURRENCES :

Lead is used in the manufacture of storage batteries, ammunition, nuclear and X-ray shielding devices, cable coverings in the power and communication industries, lead sheet for roofing, restoration of old buildings and chemically resistant linings, noise control materials, electrical and electronic equipment, motor vehicles and other transportation equipment, and as a bearing metal. It is used in brass and bronze alloys, casting metals, glass making, ceramic glazes, plastic stabilizers and paints, pipes, traps and bends, and other extruded products for building construction, fuel and storage tanks, and process vessels; and in some solders.(1,35,36) Minor uses include products such as wheel weights, yacht keels, ornamental items and stained glass.(36) The use of lead in gasoline, paints, pigments and coloured inks is restricted or eliminated in many countries.(1)

Lead is a naturally occurring metal found in small amounts in the

**\*\* EMERGENCY OVERVIEW \*\***

Bluish-white, silvery, gray heavy, ductile, soft metal. Tarnishes on exposure to air. Probably odourless. COMBUSTIBLE DUST. When heated in air, forms highly toxic lead oxide fumes. DANGER OF CUMULATIVE EFFECTS if inhaled or ingested. Symptoms may include headache, fatigue, nausea, abdominal cramps, joint pain, metallic taste in the mouth, vomiting and constipation or bloody diarrhea. Can cause harmful effects to the nervous system. POSSIBLE CANCER HAZARD - may cause cancer, based on animal information. REPRODUCTIVE HAZARD - may cause harmful effects in the unborn child; may have serious adverse effects on the male and female reproductive systems. MUTAGEN - may cause genetic damage.

**\*\* POTENTIAL HEALTH EFFECTS \*\***

**EFFECTS OF SHORT-TERM (ACUTE) EXPOSURE :**

**INHALATION :**

One case report describes moderate exposure to inorganic lead while sandblasting lead-based paint for twelve-hours. Symptoms included headache, fatigue, nausea, abdominal cramps, and joint pain.(1) Other health effects such as a metallic taste in the mouth, vomiting and constipation or bloody diarrhea might also be expected to occur.(2) Harmful effects due to short-term exposure to inorganic lead compounds are rarely seen any more because of strict controls used in workplaces where lead exposure might occur.

Lead accumulates in the body and inorganic lead compounds are well known to cause significant health effects following long-term (chronic) exposure. If a significant amount of lead has accumulated in the body, symptoms of long-term toxicity may develop after what may seem to be a short-term acute exposure.(3) For more information, refer to "Effects of Long-Term (Chronic) Exposure" below.

**SKIN CONTACT :**

Inorganic lead compounds are not known to cause skin irritation and are poorly absorbed through the skin.(1,4)

**EYE CONTACT :**

There is no relevant human or animal information available. The dusts would probably cause some tearing, blinking and mild, temporary pain as the solid material is rinsed from the eye by tears. Concentrated solutions or high levels of elemental lead fumes may also cause irritation

**INGESTION :**

Symptoms of ingestion of a very large dose over a short time period may include headache, fatigue, nausea, abdominal cramps, and joint pain. Other health effects such as a metallic taste in the mouth, vomiting and constipation or bloody diarrhea might also be expected to occur.(2) Reports of effects following short-term ingestion in adults are very rare, particularly now that strict controls are used in workplaces where lead exposure might occur.

Cases of ingestion of inorganic lead compounds by children are commonly reported. Children are much more susceptible to the effects of lead than adults and, therefore, effects observed in children are not necessarily relevant to adults.

**EFFECTS OF LONG-TERM (CHRONIC) EXPOSURE :**

Long-term health effects of inorganic lead compounds, including elemental lead, are similar following inhalation or ingestion. Inorganic lead compounds are poorly absorbed through the skin.

Blood lead levels are often used as a general indicator of how much exposure to lead has occurred. As a result, blood lead levels are provided in most reports which discuss the potential health effects of

micrograms/deciliter).(6,7)

Average blood lead levels of adults with no occupational exposure vary widely depending upon factors such as smoking habits, nutritional status, geographic area, and recreational exposures (for example, the use of firearms). In most industrialized countries, blood lead levels in adults without occupational exposure are typically less than 20-30 micrograms/deciliter.(8) In this review, blood lead levels below 50 micrograms/deciliter are considered to reflect relatively low lead exposure; blood lead levels of 51-100 micrograms/deciliter reflect moderate lead exposure, and blood lead levels above 100 micrograms/deciliter would reflect high lead exposure. Many jurisdictions require that workers be monitored more closely or be removed from exposure if their blood lead levels exceed a certain level. Contact your regulatory jurisdictions for information.

Long-term lead toxicity is commonly referred to as "plumbism" and may include effects on the following body systems.

**EFFECTS ON THE CENTRAL NERVOUS SYSTEM:** Central nervous system (CNS) or brain function has been harmed in workers with long-term, low-level lead exposure.(9) Symptoms typically occur with low to moderate exposure and include forgetfulness, irritability, tiredness, headache, fatigue, impotence, decreased libido (sexual drive), dizziness, and depression. Repeated exposure to moderate to high levels can cause encephalopathy (a progressive degeneration of certain parts of the brain). Early symptoms of encephalopathy include dullness, irritability, poor attention span, headache, muscular tremor, loss of memory and hallucinations. More severe symptoms occur at very high exposures and include delirium, lack of coordination, convulsions, paralysis, coma and death.(1) Repeated exposure to inorganic lead compounds can affect behaviour. Lead smelter workers with long-term exposure to low levels of lead have experienced altered mood states.(10) Effects at moderate exposures include disturbances in hand-eye coordination, reaction times, visual motor performance, and mental performance.(1,11) Disturbances to vision have been observed in workers after months to years of overexposure to inorganic lead compounds. Symptoms range from very slight visual changes to a gradual decrease in vision, with slow recovery or, in some instances, progression to blindness.(5) Changes in hearing ability have also been reported in lead-exposed workers, particularly those with moderate to high exposure.(12)

**EFFECTS ON THE PERIPHERAL NERVOUS SYSTEM:** Peripheral nerve function (nerves of the arms and legs) has been harmed in workers exposed to low to moderate levels of inorganic lead. Effects were shown to be reversible following a 5- month exposure.(1,6) However, only partial recovery may occur, particularly if lead exposure continues or treatment is not carried out.(2) Peripheral neuropathy (loss of myelin which insulates the nerves) has been observed following long-term overexposure to inorganic lead compounds. This disorder is often referred to as "lead palsy" and symptoms include weakness of the arms and legs and weakness and paralysis of the wrist, fingers and ankles. Decreased hand dexterity (measured by finger tapping speed) has been reported in workers with low to moderate exposure to inorganic lead.(13,14) Footdrop and wristdrop (an inability to hold the foot or hand extended) commonly occur with higher exposures.(2)

**EFFECTS ON THE DIGESTIVE SYSTEM:** Effects on the gastrointestinal tract tend to be observed following high exposure to inorganic lead compounds, although they have sometimes been noted in workers with moderate

EFFECTS ON THE KIDNEYS: Reversible kidney injury has been observed in some workers with repeated low exposure to inorganic lead compounds.(1,4,15) Irreversible kidney damage has been observed following long-term, moderate exposures.(4,16) An increased number of deaths due to kidney disease were observed in smelter and lead production workers with moderate lead exposure.(1,17)

EFFECTS ON THE BLOOD AND HEART: Inorganic lead can cause harmful effects to certain types of blood cells, including reduced hemoglobin production and reduced life span and function of red blood cells. Reduced hemoglobin production has been associated with low-level exposure to inorganic lead in the workplace.(6) Hemoglobin is the molecule responsible for carrying oxygen to body tissues. With moderate exposures, anemia has been observed in lead-exposed workers.(15) Low, moderate or high exposures to inorganic lead compounds may increase blood pressure, particularly in men.(1,6,15) In two studies, electrocardiographic (ECG) abnormalities were observed in workers with moderate exposure to inorganic lead compounds.(1)

EFFECTS ON THE THYROID AND THE IMMUNE SYSTEM: Whether or not long-term exposure to inorganic lead is associated with harmful effects on thyroid and immune system function has not been well studied yet and the available evidence is weak.(1,4,7,16) In one study, firearm instructors with low exposure to inorganic lead had reduced numbers of some types of immune system cells. This observation is a very early indicator of impaired immune response.(18) With moderate levels of exposure, workers had more colds and flu infections, but did not have impaired antibody production.(1)

SKIN SENSITIZATION: Inorganic lead compounds are not known to be skin sensitizers. One case report describes a lead-exposed employee who developed dry, red, itchy skin (dermatitis). Patch testing with elemental lead was negative. This employee and another lead-exposed employee who had developed dermatitis tested positive in patch tests with two lead salts.(19) These reports cannot be evaluated due to insufficient details.

#### CARCINOGENICITY :

The International Agency for Research on Cancer (IARC) has determined that the evidence for carcinogenicity of inorganic lead compounds to humans is inadequate and have classified these compounds as possibly carcinogenic to humans (Group 2B).(20)

A comprehensive review of more than twenty human studies involving workers exposed to inorganic lead compounds in battery industries, smelters, pigment factories, printing trades and the glass manufacturing industry concluded that there was a significant excess risk of overall cancer (stomach, lung, and bladder cancers), but not cancer of the kidney.(21)

The American Conference of Governmental Industrial Hygienists (ACGIH) has designated elemental lead as an A3 (animal carcinogen).

#### TERATOGENICITY AND EMBRYOTOXICITY :

Inorganic lead exposure during pregnancy has historically been associated with significant harmful effects on pregnancy, including increased miscarriages and stillbirths.(1,4,22) Many of these historical reports involved exposure to very high levels of lead, as well as other environmental, social and lifestyle characteristics which may have caused or contributed to the observed effects. Lead exposure which has not also caused significant toxicity in the mother has not been clearly associated with teratogenic or embryotoxic effects.(7,23-25) Several non-occupational studies indicate that low to moderate exposure

In studies with lead acetate, a closely related inorganic lead compound, neurobehavioural effects have occurred in offspring of rats at oral exposures which did not produce maternal toxicity.

#### REPRODUCTIVE TOXICITY :

Significant harmful effects have been reported in the male reproductive system following low to moderate exposures. Harmful effects on the female reproductive system have not been clearly demonstrated following low to moderate inorganic lead exposure. Harmful reproductive effects have been reported in both men and women following high level exposures. Despite limitations in human population studies, the overall literature suggests that low to moderate inorganic lead exposures are associated with significant male reproductive effects, such as low sperm count and abnormal sperm structure and mobility. (4,14,28,29) In Yugoslavia, 101 male workers exposed to low to high levels of inorganic lead had reduced semen volume and density; reduced total, mobile and viable sperm; and increased numbers of abnormal sperm. (17) Another study of 150 male workers with moderate to high, long-term exposure to inorganic lead compounds showed signs of reduced fertility, as measured by reduced viability of spermatozoa, low sperm counts and abnormal sperm structure. (30) Similar effects have been observed in animal studies. Associations between workplace exposure of the father and an increased rate of miscarriage or fetal death have also been reported. (31,32) A critical review of the literature which relates these effects directly to the male (that is, through the sperm) indicates the information is limited and incomplete and that published results are conflicting. (7) Therefore, no firm conclusions can be drawn. Historically, these effects have been related to poor hygiene procedures resulting in exposure of a pregnant woman to lead which has been carried home on her partner's work clothing.

There are historical reports of reduced fertility and menstrual disorders in women with relatively high inorganic lead exposures. (7,29) There are no recent human studies which meet current scientific standards. There is no relevant information available for elemental lead. Animal studies using lead acetate, a closely related chemical, are inconclusive.

#### MUTAGENICITY :

Several studies have reported positive results (chromosomal aberrations) in the white blood cells of workers with low to moderate inorganic lead exposure. Other studies have shown no increase in chromosomal aberrations in workers with similar exposures. (1) In studies with the related chemical, lead acetate, positive results have been reported in animals exposed orally.

#### TOXICOLOGICALLY SYNERGISTIC MATERIALS :

Significantly increased kidney toxicity was reported in rats given the related chemical, lead acetate, and selected nitroso- or amide-type chemicals. (20) Nutritional status and exposure to other metals such as calcium, phosphorous, iron, zinc and copper may influence inorganic lead absorption and toxicity. (1)

#### POTENTIAL FOR ACCUMULATION :

Inorganic lead compounds are absorbed into the body following inhalation or ingestion. It is estimated that 30-50% of inhaled lead and that 5-15% of ingested lead is absorbed. The amount of lead absorbed is affected by many factors, including particle size (inhalation), as well as age, nutritional status and time of last meal (ingestion). Inorganic lead compounds are poorly absorbed through the skin. Once absorbed, inorganic lead compounds are distributed throughout the body. They can readily cross the placenta, reaching the unborn child. The majority of absorbed lead is excreted in the urine and feces. Small amounts are also excreted in sweat, hair, fingernails and breast milk. Some lead is not excreted, but is stored in the bones and accumulates in the body.

\*\*\* SECTION 4. FIRST AID MEASURES \*\*\*

INHALATION :

Take proper precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment). If symptoms are experienced, remove source of contamination or have victim move to fresh air. Obtain medical attention.

SKIN CONTACT :

Avoid direct contact. Wear chemical protective clothing, if necessary. Flush with lukewarm, gently flowing water for 5 minutes or until chemical is removed. Obtain medical advice.

EYE CONTACT :

Avoid direct contact. Wear chemical protective gloves, if necessary. Do not allow victim to rub eye(s). Let the eye(s) water naturally for a few minutes. Have victim look right and left, and then up and down. If particle/dust does not dislodge, flush with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding the eyelid(s) open. If irritation persists, obtain medical attention. DO NOT attempt to manually remove anything stuck to the eye(s).

INGESTION :

NEVER give anything by mouth if the victim is rapidly losing consciousness, is unconscious or is convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim drink 240 to 300 mL (8 to 10 oz.) of water to dilute material in the stomach. If vomiting occurs naturally, rinse mouth and repeat administration of water. Obtain medical attention immediately.

FIRST AID COMMENTS :

All first aid procedures should be periodically reviewed by a doctor familiar with the material and its conditions of use in the workplace. Lead acetate can accumulate in the body and cause significant long-term health effects. Medical advice should be sought following any exposure.

NOTE TO PHYSICIANS :

Many jurisdictions have specific regulations for lead. These regulations may include requirements for medical surveillance programs, including pre-employment and pre-placement examinations, periodic medical examinations, clinical tests, health education and record keeping. Obtain detailed information from the appropriate government agency in relevant jurisdictions.

\*\*\* SECTION 5. FIRE FIGHTING MEASURES \*\*\*

FLASH POINT :

Not applicable

LOWER FLAMMABLE (EXPLOSIVE) LIMIT (LFL/LEL) :

Airborne powder or dust can ignite and explode.(37-39) The minimum explosible concentration is not available.

UPPER FLAMMABLE (EXPLOSIVE) LIMIT (UFL/UEL) :

Not well defined.(39)

AUTOIGNITION (IGNITION) TEMPERATURE :

Not applicable

SENSITIVITY TO MECHANICAL IMPACT :

Not sensitive. Stable material.

SENSITIVITY TO STATIC CHARGE :

Lead metal will not accumulate static charge. It has a high electrical conductivity.(35,36) Under certain conditions, airborne lead powder or dust can explode when ignited by an electrostatic spark or other ignition source.(37-39)

ELECTRICAL CONDUCTIVITY :

7.8 (Cu = 100); 4.84 MS/m or  $4.84 \times 10^{18}$  pS/m at 20 deg C (35)  
20.65 microohms.cm at 20 deg C; 27.02 microohms.cm at 100 deg C; 96.73

certain conditions, a dust cloud of lead can explode when ignited by a spark or flame. See references 38 and 39 for a list of the main ignition sources of sufficient energy to cause a dust explosion. When evaluating the explosion hazard of a specific process or sample of material, the important factors to consider include: particle size and shape, dust concentration, the nature of any impurities, oxygen concentration, humidity, and extent of containment.(39)

IGNITION SENSITIVITY: Not available

EXPLOSION SEVERITY: Not available

The EXPLOSIBILITY INDEX; Not available

MINIMUM IGNITION TEMPERATURE: 790 deg C (1454 deg F) (cloud) (37,38); 290 deg C (554 deg F) (layer) (38); 710 deg C (1310 deg F) (cloud); 270 deg C (518 deg F) (layer) (lead, atomized) (39)

MINIMUM CLOUD IGNITION ENERGY: Did not ignite (38)

MAXIMUM EXPLOSION PRESSURE: 20.68 kPa (3 psi or 0.2 bar) (37,38)

MAXIMUM RATE OF PRESSURE RISE: 689 kPa/sec (greater than 100 psi/sec or 7 bar/sec) (37,38)

#### EXTINGUISHING MEDIA :

Lead metal is not combustible and does not support combustion. Use extinguishing media appropriate to surrounding fire conditions.(40) Finely divided lead may ignite and burn.(41) Smother fire with dry sand, clay, ground limestone, or sodium chloride based extinguishers, use approved Class D dry powder extinguishers or blanket the fire with an inert gas such as argon, helium or neon.(42,43)

#### FIRE FIGHTING INSTRUCTIONS :

Evacuate area and fight fire from a safe distance or a protected explosion-resistant location or maximum possible distance. Move containers from the fire area if it can be done without risk. Confine and smother fire, if possible. Small metal fires can be controlled by the recommended extinguishing agents, but large fires may be impossible to extinguish. In this case isolate the fire, protect surroundings and allow the fire to burn itself out.

Lead and its decomposition products are hazardous to health. Do not enter without wearing specialized protective equipment suitable for the situation. Firefighter's normal protective clothing (Bunker Gear) will not provide adequate protection. A full-body encapsulating chemical resistant suit with positive pressure self-contained breathing apparatus (MSHA/NIOSH approved or equivalent) may be necessary.

### \*\*\* SECTION 6. ACCIDENTAL RELEASE MEASURES \*\*\*

#### SPILL PRECAUTIONS :

Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. Wear adequate personal protective equipment.

Notify government occupational health and safety and environmental authorities.

#### CLEAN-UP :

Prevent material from entering sewers or waterways.

Small spills: Shovel into clean, dry, labelled containers and cover. Flush area with water.

Large spills: Contact fire and emergency services and supplier for advice.

### \*\*\* SECTION 7. HANDLING AND STORAGE \*\*\*

#### HANDLING :

This material is a VERY TOXIC (POSSIBLE CANCER HAZARD, REPRODUCTIVE HAZARD, TERATOGEN, MUTAGEN) solid. There is a DANGER OF CUMULATIVE

If lead powder is released, immediately put on a suitable respirator and leave the area until the severity of the release is determined. In case of leaks or spills, escape-type respiratory protective equipment should be available in the work area. Unprotected persons should avoid all contact with this chemical including contaminated equipment.

Immediately report leaks, spills or ventilation failures.

Be aware of typical signs and symptoms of poisoning and first aid procedures. Any signs of illness should be reported immediately to supervisory personnel.

Use in clearly posted, designated area(s). Control access to designated area. Access doors must remain closed while this material is present.

When handling lead powder on a large scale, closed handling systems for processes should be used. If this is not possible, use in the smallest possible amounts in appropriate labelled, containment devices (e.g. fume hood). Containment devices should be made of smooth, unbreakable, compatible material. Maintain containment devices at appropriate air flow and negative pressure. Check regularly.

Avoid generating dusts. Prevent the release of dust into workplace air.

Use the proper tools to open containers. Ripping open a container can cause an uneven tear, thus making spills more likely. Cover work surfaces with compatible, chemical resistant and/or disposable material for easier containment and clean-up of spills. Good housekeeping is very important. Keeping work areas clean is essential. Use work surfaces that can be easily decontaminated.

Avoid generating vapours or mists. Prevent the release of vapours/mist into workplace air. To avoid splashing, carefully dispense into sturdy containers made of compatible materials.

Do not use with incompatible materials such as strong oxidizing agents, strong acids and strong bases. See Incompatibilities - Materials to Avoid section for more information. Never return contaminated material to its original container.

Prevent damage to containers. Label containers. Open containers carefully on a stable surface. Keep containers closed when not in use.

Assume that empty containers contain residues which are hazardous.

Maintain good personal hygiene. When handling on a large scale, a double locker-shower set-up is usually necessary.

Follow handling precautions on Material Safety Data Sheet. Have suitable emergency equipment for fires, spills and leaks readily available. Maintain handling equipment. Comply with applicable regulations.

#### STORAGE :

Store in a cool, dry, ventilated area, out of direct sunlight and away from heat sources. Keep quantity stored as small as possible.

Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Storage facilities should be made of fire-resistant materials. Keep storage area separate from work areas, eating areas and protective equipment storage. Post warning signs. Inspect periodically for damage or leaks.

Inspect all incoming containers to make sure they are properly labelled and not damaged. Store in suitable, unbreakable, labelled containers (usually the shipping container). Store away from incompatible materials, such as strong oxidizing agents, strong acids and strong bases. See Incompatibilities - Materials to Avoid section for more information.

Store containers at a convenient height for handling, below eye level if possible. Keep containers tightly closed when not in use and when empty. Protect from damage. Keep empty containers in separate storage area. Empty containers may contain hazardous residues. Keep closed. Have appropriate fire extinguishers and spill clean-up equipment in storage area.

ways. The measures appropriate for a particular worksite depend on how this material is used and on the extent of exposure. This general information can be used to help develop specific control measures. Ensure that control systems are properly designed and maintained. Comply with occupational, environmental, fire, and other applicable regulations.

#### SAMPLING AND ANALYSIS :

Use appropriate instrumentation and sampling strategy (location, timing, duration, frequency, and number of samples). Interpretation of the sampling results is related to these variables and the analytical method. Sampling should be carried out by trained personnel.

NIOSH METHOD 7082 - NIOSH manual of analytical methods. 4th edition. Volume 2. Fully evaluated method. Collection on mixed cellulose ester membrane filter. Analysis by atomic absorption spectrophotometry (AAS) (flame). Estimated detection limit: 2.6 micrograms (ug).

NIOSH METHOD 7105 - NIOSH manual of analytical methods. 4th edition. Volume 2. Partially evaluated method. Collection on mixed cellulose ester membrane filter. Analysis by atomic absorption spectrophotometry (AAS) (graphite furnace). Estimated detection limit: 0.02 ug.

NIOSH METHOD 7300 - NIOSH manual of analytical methods. 4th edition. Volume 2. Partially evaluated method for Elements by ICP. Collection on mixed cellulose ester membrane filter. Analysis by inductively coupled argon plasma (ICP-AES).

#### ENGINEERING CONTROLS :

Engineering methods to control hazardous conditions are preferred. Methods include mechanical (local exhaust) ventilation, process or personnel enclosure and control of process conditions. Because of the high potential hazard associated with this substance, stringent control measures such as enclosure or isolation may be necessary. Administrative controls and personal protective equipment may also be required.

Use a ventilation system separate from other exhaust ventilation systems. Exhaust directly to the outside. Locate dust collectors outside or where permitted by regulation. Supply sufficient replacement air to make up for air removed by exhaust systems.

#### PERSONAL PROTECTIVE EQUIPMENT :

If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved respiratory protection. Have appropriate equipment available for use in emergencies such as spills or fire.

If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection. Refer to the CSA Standard Z94.4-93, "Selection, Care, and Use of Respirators", available from the Canadian Standards Association, Rexdale, Ontario, M9W 1R3.

#### RESPIRATORY PROTECTION GUIDELINES :

NIOSH RECOMMENDATIONS FOR LEAD CONCENTRATIONS IN AIR (45):

UP TO 0.5 mg/m<sup>3</sup>: Respirator with high-efficiency particulate filter(s); or SAR.

UP TO 1.25 mg/m<sup>3</sup>: SAR operated in a continuous-flow mode; or powered air- purifying respirator with high-efficiency particulate filter.

UP TO 50 mg/m3: Positive pressure SAR.

UP TO 100 mg/m3: Positive pressure, full-facepiece SAR.

EMERGENCY OR PLANNED ENTRY INTO UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

ESCAPE: Full-facepiece respirator with high-efficiency particulate filter(s); or escape-type SCBA.

NOTE: The IDLH concentration for lead is 100 mg/m3 (as Pb). The purpose of establishing an IDLH value is to ensure that the worker can escape from a given contaminated environment in the event of failure of the most protective respiratory protection equipment. In the event of failure of respiratory protective equipment every effort should be made to exit immediately.

The respirator use limitations specified by the approving agency and the manufacturer must be observed.

Recommendations apply only to NIOSH approved respirators.

ABBREVIATIONS: SAR = supplied-air respirator; SCBA = self-contained breathing apparatus; IDLH = immediately dangerous to life or health.

EYE/FACE PROTECTION :

Chemical safety goggles. A face shield may also be necessary.

SKIN PROTECTION :

Chemical protective gloves, coveralls, boots, and/or other protective clothing to prevent skin contact.

RESISTANCE OF MATERIALS FOR PROTECTIVE CLOTHING :

Most materials commonly used in protective clothing are probably adequate. No specific guidelines are available. Contact chemical manufacturer/supplier for advice.

PERSONAL HYGIENE :

Remove contaminated clothing promptly. Keep contaminated clothing in closed containers. Discard or launder before rewearing. Inform laundry personnel of contaminant's hazards.

When handling on a large scale, do not wear work clothing home. A double locker-shower setup is usually required.

Wash hands thoroughly before eating, smoking or using the washroom. Do not eat, drink, or smoke in work areas.

\*\* EXPOSURE GUIDELINES \*\*

\* THRESHOLD LIMIT VALUES (TLVs) / AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH) / 2002 \*

TIME-WEIGHTED AVERAGE (TLV-TWA) : 0.05 mg/m3, Carcinogenicity Designation A3  
TLV BASIS - CRITICAL EFFECT(S) : CNS (central nervous system)  
GI (gastrointestinal)  
Blood  
Kidney  
Reproductive

TLV COMMENTS :

CARCINOGENICITY DESIGNATION A3 - Animal Carcinogen: Substance is carcinogenic in laboratory animals under conditions that are not considered relevant to worker exposure. Available human studies and evidence suggest that the substance is not likely to cause cancer in humans except under unusual or unlikely routes or levels of exposure. Worker exposure to an A3 carcinogen should be controlled to levels as

Consult the BEI documentation for further information.

NOTE: In many jurisdictions, exposure limits are similar to the ACGIH TLVs. Since the manner in which exposure limits are established, interpreted, and implemented can vary, obtain detailed information from the appropriate government agency in each jurisdiction. Many jurisdictions have specific regulations requiring worksite programs for lead. Obtain detailed information from the appropriate government agency in each jurisdiction.

\* PERMISSIBLE EXPOSURE LIMITS (PELs) / FINAL RULE LIMITS /  
US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) \*

TIME-WEIGHTED AVERAGE (PEL-TWA) : 0.05 mg/m3  
FINAL RULE LIMIT PEL COMMENTS :  
See OSHA legislation 1910.1025

NOTE: The OSHA PEL Final Rule Limits are currently  
non-enforceable due to a court decision. The OSHA  
PEL Transitional Limits are now in force.

\* PERMISSIBLE EXPOSURE LIMITS (PELs) / TRANSITIONAL LIMITS /  
US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) \*

TIME-WEIGHTED AVERAGE (PEL-TWA) : 0.05 mg/m3

TRANSITIONAL LIMIT PEL COMMENTS :  
See OSHA legislation 1910.1025

### \*\*\* SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES \*\*\*

MOLECULAR WEIGHT : 207.19  
CONVERSION FACTOR :  
1 ppm = 8.46 mg/m3; 1 mg/m3 = 0.118 ppm at 25 deg C (calculated)  
MELTING POINT : 327.4 deg C (621.3 deg F) (33,35,36)  
BOILING POINT : 1740 deg C (3164 deg F) (1,33,36)  
RELATIVE DENSITY (SPECIFIC GRAVITY) :  
11.34 at 20 deg C (water=1) (33,35,36)  
SOLUBILITY IN WATER :  
Insoluble (1,14)  
SOLUBILITY IN OTHER LIQUIDS :  
Nitric acid and hot concentrated sulfuric acid; insoluble in organic  
solvents.(1)  
COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT) :  
Not applicable  
pH VALUE : Not applicable  
VAPOUR DENSITY : 7.14 (air=1)  
VAPOUR PRESSURE : Approximately zero at normal room  
temperature; 0.133 kPa (1 mm Hg) at  
980 deg C (35,36)  
SATURATION VAPOUR CONCENTRATION : Approximately zero at normal temperatures  
(calculated)  
EVAPORATION RATE : Not applicable  
CRITICAL TEMPERATURE : Not applicable  
OTHER PHYSICAL PROPERTIES :  
VISCOSITY-DYNAMIC: 2.75 mPa.s (2.75 centipoise) at 327.4 deg C; 1.70  
mPa.s (1.70 centipoise) at 550 deg C (molten lead) (35,36)  
SURFACE TENSION: 444 mN/m (444 dynes/cm) at 327.4 deg C (molten lead)  
(36)

STABILITY :

Normally stable. Fresh cut or cast lead surfaces oxidize rapidly to form an insoluble protective layer of basic lead carbonate.(36)

HAZARDOUS POLYMERIZATION :

Does not occur.

INCOMPATIBILITY - MATERIALS TO AVOID :

STRONG ACIDS (e.g. hot concentrated nitric acid, boiling concentrated hydrochloric acid or sulfuric acid) - may react vigorously or violently.(34,40)

HYDROGEN PEROXIDE - contact may cause violent decomposition.(41,44)

HYDROGEN PEROXIDE and TRIOXANE - mixtures may be detonated by heat, shock, or spontaneously after contact with metallic lead.(41)

SODIUM AZIDE - may form lead azide, an unstable, explosive compound.(44)

AMMONIUM NITRATE, SODIUM ACETYLIDE, SODIUM CARBIDE or CHLORINE

TRIFLUORIDE - react violently or explosively with powdered lead.(41,44)

ZIRCONIUM - an alloy of lead and 10-70% zirconium will ignite when struck with a hammer.(44)

HAZARDOUS DECOMPOSITION PRODUCTS :

None reported.

CONDITIONS TO AVOID :

LEAD POWDER: Generation of dust, sparks, flames or other sources of ignition.

CORROSIVITY TO METALS :

Not corrosive.

\*\*\* SECTION 11. TOXICOLOGICAL INFORMATION \*\*\*

NOTE: Results from studies with lead acetate are considered relevant for identifying hazards associated with other inorganic lead compounds, including elemental lead, for two reasons. First, it is the lead component of lead acetate which is responsible for the toxic effects observed in these studies. Second, although different inorganic forms of lead have different water solubilities, absorption of inorganic salts following inhalation, which is the main route of occupational exposure, has been demonstrated to be similar.(1) CHEMINFO record 131 contains a review of the information available for lead acetate.

Standard animal toxicity values (for example, LD50s) are not available for elemental lead.

EFFECTS OF SHORT-TERM (ACUTE) AND LONG-TERM (CHRONIC) EXPOSURE: Studies on the short- and long-term health effects of elemental lead on animals have not been conducted because effects in humans are well-defined.

TERATOGENICITY/EMBRYOTOXICITY/FETOTOXICITY: No relevant information for elemental lead was located. In studies with lead acetate, neurobehavioural effects have occurred in offspring of rats at oral exposures which did not produce maternal toxicity.

REPRODUCTIVE TOXICITY: No relevant information for elemental lead was located. Altered testicular structure, effects on sperm, and effects on hormonal and biochemical processes have been observed in male animals exposed to lead acetate. Results of studies on female animals exposed to lead acetate are inconclusive. Effects on fertility have been observed in multi-generation studies with exposure to lead acetate, but only at doses which have also caused toxicity in the parents.

CARCINOGENICITY: The International Agency for Research on Cancer (IARC) has determined that the evidence for carcinogenicity to animals is

MUTAGENICITY: The mutagenicity of elemental lead has not been investigated in animal or cell systems. In studies with lead acetate, positive results (chromosome aberrations) have been reported in rats, mice and monkeys exposed orally.

\*\*\* SECTION 12. ECOLOGICAL INFORMATION \*\*\*

NOTE : Inclusion of Ecological Information on an MSDS is optional under the US Hazard Communication Standard and the Canadian Controlled Products Regulations (WHMIS). In other jurisdictions, inclusion of Ecological Information may be a requirement. For specific requirements, contact the relevant regulatory authorities in the jurisdiction where the MSDS is intended to be used.

The American National Standard for Hazardous Industrial Chemicals - Material Safety Data Sheets - Preparation (ANSI 2400.1-1998) provides advice on data that could be included in this section, as well as ecotoxicological tests and issues.

Databases in CCOHS's CD-ROM and Web collection which contain useful Ecological Information include CESARS, HSDB(R) (Hazardous Substances Data Bank) and CHRIS (Chemical Hazards Response Information System).

\*\*\* SECTION 13. DISPOSAL CONSIDERATIONS \*\*\*

Review federal, provincial and local government requirements prior to disposal. Store material for disposal as indicated in Storage Conditions.

\*\*\* SECTION 14. TRANSPORT INFORMATION \*\*\*

\*\* CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG)  
SHIPPING INFORMATION \*\*

This chemical is not specifically listed in the Canadian Transportation of Dangerous Goods Regulations. However, it may be regulated as a part of a chemical family or group Not Otherwise Specified (N.O.S.) (e.g. LIQUID DYES N.O.S.). Consult the regulation.

NOTE: This information incorporates the Transportation of Dangerous Goods Regulations SOR/2001-286, effective August 1, 2002.

\*\* US DEPARTMENT OF TRANSPORT (DOT) HAZARDOUS  
MATERIALS SHIPPING INFORMATION (49 CFR) \*\*

This chemical is not specifically listed in the US hazardous materials shipping regulations (49 CFR, Table 172.101). However it may be regulated as part of a chemical family or group Not Otherwise Specified (N.O.S.) (e.g. mercury-based pesticides). Consult the regulation.

NOTE : This information was taken from the US Code of Federal Regulations Title 49 - Transportation and is effective October 1, 1997.

\*\*\* SECTION 15. REGULATORY INFORMATION \*\*\*

\*\* CANADIAN WORKPLACE HAZARDOUS MATERIALS  
INFORMATION SYSTEM (WHMIS) \*\*

Chronic toxicity - very toxic - other  
Carcinogenicity - very toxic - other  
Teratogenicity and embryotoxicity - very toxic - other  
Reproductive toxicity - very toxic - other  
Mutagenicity - toxic - other

WHMIS INGREDIENT DISCLOSURE LIST :

Included for disclosure at 0.1% or greater

DETAILED WHMIS CLASSIFICATION ACCORDING TO CRITERIA :

CLASS A - COMPRESSED GAS: Does not meet criteria.

CLASS B - FLAMMABLE & COMBUSTIBLE MATERIAL: Does not meet criteria for legislated classes. However, powdered lead is a combustible dust.

CLASS C - OXIDIZING MATERIAL: Does not meet criteria.

CLASS D - POISONOUS AND INFECTIOUS MATERIAL. DIVISION 1 - IMMEDIATE AND SERIOUS TOXIC EFFECTS: Insufficient information.

Acute Lethality: Insufficient information; standard animal toxicity values are not available.

CLASS D - POISONOUS AND INFECTIOUS MATERIAL. DIVISION 2 - OTHER TOXIC EFFECTS: Meets criteria for both "Very toxic" and "Toxic" material.

See detailed evaluation below.

Chronic Health Effects: "Very toxic"; long-term occupational exposure to low levels of inorganic lead has resulted in significant health effects

Carcinogenicity: "Very toxic"; IARC Group 2B.

Teratogenicity and Embryotoxicity: "Very toxic"; animal studies have shown neurobehavioural effects in the offspring of rats orally exposed to the closely related inorganic lead compound, lead acetate, at doses which did not produce maternal toxicity.

Reproductive Toxicity: "Very toxic"; significant effects reported in the male reproductive system following low to moderate lead exposures.

Mutagenicity: "Toxic"; positive results (chromosomal aberrations) in the white blood cells of employees with low to moderate exposure inorganic lead exposure reported in several studies; and in rats, mice and monkeys exposed orally to the closely related inorganic lead compound, lead acetate.

Respiratory Sensitization: Does not meet criteria; not reported as human respiratory sensitizer.

Skin Sensitization: Insufficient information; two case reports cannot be evaluated.

Skin Irritation: Does not meet criteria; inorganic lead compounds are not known to cause skin irritation.

Eye Irritation: Insufficient information; no relevant human or animal information.

CLASS E - CORROSIVE MATERIAL: Does not meet criteria; lead is not corrosive to metals.

CLASS F - DANGEROUSLY REACTIVE MATERIAL: Does not meet criteria.

\*\* US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)  
HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) \*\*

OSHA HAZARD COMMUNICATION EVALUATION :

Meets criteria for hazardous material, as defined by 29 CFR 1910.1200.

\*\* EUROPEAN UNION (EU)  
CLASSIFICATION AND LABELLING INFORMATION \*\*

EU CLASSIFICATION :

Toxic for Reproduction, Category 1; Toxic for Reproduction, Category 3; Harmful; Danger of cumulative effects; Dangerous for the environment.

[Repr.Cat.1;Repr.Cat.3;Xn;R:33;N] (46)

EU RISK PHRASES :

May cause harm to the unborn child. Also, harmful by inhalation and if

accident or if you feel unwell, seek medical advice immediately (show label where possible). This material and/or its container must be disposed of as hazardous waste. Avoid release to the environment. Refer to special instructions/safety data sheet. [S:53-45-60-61] Safety phrases relate to the highest concentration division indicated, but may also be applicable to lower concentrations.

EU COMMENTS :

CONCENTRATION GREATER THAN OR EQUAL TO 5%: Toxic: May cause harm to the unborn child. Also, harmful by inhalation and if swallowed. Danger of cumulative effects. Possible risk of impaired fertility.

[T;R:61-20/22-33-62]

CONCENTRATION GREATER THAN OR EQUAL TO 1% AND LESS THAN 5%: Toxic: May cause harm to the unborn child. Also, harmful by inhalation and if swallowed. Danger of cumulative effects. [T;R:61-20/22-33]

CONCENTRATION GREATER THAN 0.5% AND LESS THAN 1%: Toxic: May cause harm to the unborn child. Danger of cumulative effects. [T;R:61-33]

The concentration stated or, in the absence of such concentrations, the general concentrations of Directive 1999/45/EC are the percentages by weight of the metallic element calculated with reference to the total weight of the preparation.

There is no EC listing for elemental lead. The information provided above is for lead compounds and may be applicable to elemental lead.

\*\*\* SECTION 16. OTHER INFORMATION \*\*\*

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Information on chemicals reviewed in the CHEMINFO database is drawn from a number of publicly available sources. A list of general references used to compile CHEMINFO records is available in the database Help.

REVIEW/PREPARATION DATE :

1998-05-27

REVISION INDICATORS :

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EU Comments; 2000-04-01  
Bibliography; 2000-04-01

\*\*\* END OF RECORD \*\*\*

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 \* C H E M I N F O \*  
 \*  
 \* Canadian Centre for Occupational Health and Safety \*  
 \* \* \* \* \* Issue : 2004-2 (May, 2004) \*

\*\*\* SECTION 1. CHEMICAL IDENTIFICATION \*\*\*

CHEMINFO RECORD NUMBER : 103  
 CCOHS CHEMICAL NAME : Trichloroethylene  
 SYNONYMS :  
 \* Acetylene trichloride  
 \* 1-Chloro-2,2-dichloroethylene  
 \* 1,1-dichloro-2-chloroethylene  
 \* Ethinyl trichloride  
 \* Ethylene trichloride  
 \* Tri  
 \* Trichloroethene  
 \* 1,1,2-Trichlorethylene  
 CHEMICAL NAME FRENCH : Trichloroéthylène  
 TRADE NAME(S) :  
 Triclene  
 Trilene  
 Vitran  
 CAS REGISTRY NUMBER : 79-01-6  
 UN/NA NUMBER(S) : 1710  
 RTECS NUMBER(S) : KX4550000  
 EU EINECS/ELINCS NUMBER : 201-167-4  
 CHEMICAL FAMILY : Halogenated aliphatic hydrocarbon /  
 unsaturated halogenated hydrocarbon / halogenated alkene / haloalkene /  
 trihaloalkene / chloroalkene / trichloroalkene  
 MOLECULAR FORMULA : C2-H-Cl3  
 STRUCTURAL FORMULA : Cl2C=CHCl

STATUS :

The CHEMINFO record for this chemical is complete. The full format  
 ("TOTAL") provides a detailed evaluation of health, fire and  
 reactivity hazards, as well as recommendations on topics such as  
 handling and storage, personal protective equipment, accidental  
 release and first aid.

\*\*\* SECTION 2. DESCRIPTION \*\*\*

APPEARANCE AND ODOUR :

Clear, colourless liquid with an ethereal, sweet, chloroform-like  
 odour. (1,33)

ODOUR THRESHOLD :

A wide range of values have been reported; 0.5 to 167 ppm. Reliable  
 values are 82 ppm (detection) and 110 ppm (recognition). (34) Some people  
 may not smell trichloroethylene at higher concentrations because they  
 become accustomed to the odour.

WARNING PROPERTIES :

POOR - odour threshold is above the TLV. Irritation occurs above the  
 TLV.

#### COMPOSITION/PURITY :

Trichloroethylene is available commercially in a number of grades, including high-purity, electronic, metal degreasing and extraction grades. It typically has a purity above 99%. Impurities include other halogenated hydrocarbons such as tetrachloroethane, dichloroethylene, and trichloroethane. (22,35)

Stabilizers are added to prevent decomposition by air and light, and to prevent trichloroethylene from becoming acidic and corrosive. Some 50 known stabilizers are used in trichloroethylene formulations and include amines, pyrroles, mixtures of epoxides and esters, phenols, and alcohols. Stabilizers are generally added at concentrations of 1% or less and to be effective must be present in both the liquid and vapour phases. (22,35) Epichlorohydrin has been used as a stabilizer in the past, but concern over its toxicity has led to elimination of its use. (29)

#### USES AND OCCURRENCES :

Trichloroethylene is predominantly used for vapour degreasing of metal parts in the automotive and metal industries. It is also used as a component of adhesives and as a solvent in paint-strippers, lubricants, paints, varnishes, pesticides, cold metal cleaners, rubbers and elastomers. It is used as a low temperature heat-transfer medium and as a chemical intermediate in the production of pharmaceuticals, flame retardant chemicals and insecticides. It is used in metal phosphatizing systems, textile processing, the production of polyvinyl chloride and aerospace operations. (1,29,36)

Its historical use in foods, beverages (decaffeination of coffee), pet foods, medicine, pharmaceuticals and cosmetics has been banned because of its toxicity. (1,2,29)

### \*\*\* SECTION 3. HAZARDS IDENTIFICATION \*\*\*

#### \*\* EMERGENCY OVERVIEW \*\*

Clear, colourless liquid with a sweet, ethereal, chloroform-like odour. Can probably burn if strongly heated, or be ignited by a high energy source. Can decompose at high temperatures forming toxic gases such as hydrogen chloride, chlorine and phosgene. Closed containers may rupture and explode if heated. May accumulate in low lying areas. Vapour causes irritation of the nose and throat. Central nervous system depressant. Vapour may cause headache, nausea, dizziness, drowsiness, incoordination, and confusion. High vapour concentrations may cause unconsciousness and death. Causes skin and eye irritation. Aspiration hazard. Swallowing or vomiting of the liquid may result in aspiration (breathing) into the lungs. SUSPECT CANCER HAZARD - may cause cancer, based on human information. MUTAGEN - may cause genetic damage, based on animal information.

#### \*\* POTENTIAL HEALTH EFFECTS \*\*

#### EFFECTS OF SHORT-TERM (ACUTE) EXPOSURE :

##### INHALATION :

Short-term exposure causes irritation of the nose and throat and central nervous system (CNS) depression, with symptoms such as drowsiness, dizziness, giddiness, headache, loss of coordination. High concentrations have caused numbness and facial pain, reduced eyesight, unconsciousness, irregular heartbeat and death.

Trichloroethylene is noticeable by smell at approximately 82 ppm and above. However, people can become accustomed to the odour and may not

smell it until higher concentrations are reached. In one study, exposure to 110 ppm for 8 hours produced fatigue and drowsiness. Other studies have shown no significant effects following exposure to 200 or 300 ppm for less than 4 hours. At 160-250 ppm, the odour is persistent. Lightheadedness has been reported following exposure to 350-400 ppm for 3 hours. At 1000-1200 ppm, the odour is very strong and unpleasant. Lightheadedness, reduced hand-eye coordination and dizziness have been observed after several minutes. At 2000 ppm, the odour is difficult to tolerate, irritation of the nose and throat is strong, and drowsiness, dizziness and nausea occur within 5 minutes. Very high concentrations have produced death due to CNS effects, and, in rare cases, irregular heart beat. In one case, pulmonary edema (a potentially fatal accumulation of fluid in the lungs) was reported. The employee was welding a surface that had been washed in trichloroethylene. The pulmonary edema likely resulted from exposure to phosgene which is formed upon heating of trichloroethylene. (1,7,9,19,21,22)

Effects on behaviour and coordination have been observed in some studies. In one study, exposure to 110 ppm resulted in decreased performance in tests measuring reaction time, dexterity, perception, and memory. Similar effects were not observed when the study was repeated. In general, no significant effects have been observed with exposures to 100 ppm or below. (1,9,22,24)

Numbness and discomfort of the face and jaw weakness (trigeminal nerve effects) and serious visual disturbances, including reduced eyesight and blurred or double vision, have been reported following exposure to high concentrations. Some of the effects may persist for several months. These effects may actually be caused by other chemicals formed when trichloroethylene decomposes in the presence of strong alkaline materials (e.g. dichloroacetylene). (1,7,9,22)

Sometimes, permanent nervous system damage and/or liver injury have resulted from severe overexposure. In most cases, the individuals had intentionally inhaled very high concentrations of trichloroethylene for its intoxicating effects. (1,22)

#### SKIN CONTACT :

Trichloroethylene is a severe skin irritant, based on human and animal evidence. A 58-year old man accidentally fell into a trichloroethylene reservoir bath head first during a degreasing operation. A fellow employee immediately pulled him out, so he was in the bath only 3-5 minutes. Chemical burns were observed on his face, buttocks and back. The burn area was estimated to be about 30% of his total body surface. The burns healed within 10 days without skin grafting. (59) Prolonged contact with the liquid has caused reddening of the skin, irritation and blister formation.

The concentrated vapour, especially at elevated temperatures, can also cause severe redness and irritation. Several cases of very severe skin irritation have been reported in employees exposed to unspecified or high concentrations (up to 165 ppm) of trichloroethylene for a relatively short time (up to 5 weeks). In most cases, liver impairment and exposure to other several other potentially harmful chemicals were also reported. (26,31,32)

Trichloroethylene can be absorbed through the skin. However, significant harmful effects are not expected to occur by this route of exposure.

#### EYE CONTACT :

The liquid is a severe eye irritant, based on limited human information and animal evidence. One report indicates that a splash drop of trichloroethylene caused smarting pain and injury to the surface tissue of the eye. (7)

Mild irritation has been reported by some volunteers exposed to 160 or 200 ppm vapour.(1,19) Other sources report no eye irritation at 350-400 ppm. Severe eye irritation, with temporary clouding of the cornea, has been reported in people exposed to vapour concentrations so high they became unconscious.(7,22)

Serious disturbances in eyesight, including reduced eyesight and blurred, double and tunnel vision, have been reported in people with high inhalation exposure. See "Inhalation", above, for additional information.

#### INGESTION :

Ingestion causes a burning sensation in the mouth and throat, followed by abdominal pain and signs and symptoms central nervous system (CNS) depression, as described for inhalation exposure above. Accidental ingestion of 30 mL to 500 mL (2 tbsp to 16 ozs) has caused muscle weakness, vomiting and unconsciousness or delirium, with recovery within 2 weeks. Effects on the heart, liver and kidneys have also been reported. In one case, ingestion of less than 50 mL was reported to be fatal due to kidney and liver failure.(1,19) Some of the harmful effects described, e.g. the liver effects, may be caused by other chemicals (stabilizers) added to trichloroethylene.(9)

Trichloroethylene can probably be aspirated, based on its physical properties. Aspiration is the inhalation of the chemical into the lungs during ingestion or vomiting. Severe lung irritation, damage to the lung tissues and death may result. Ingestion is not a typical route of occupational exposure.

#### EFFECTS OF LONG-TERM (CHRONIC) EXPOSURE :

##### NERVOUS SYSTEM :

Long-term occupational exposure may cause signs and symptoms of central nervous system (CNS) depression such as headaches, dizziness, altered mood, loss of memory and inability to concentrate or sleep. These effects have also been related to long-term occupational exposure to other organic solvents and are sometimes generally referred to as "organic solvent syndrome". It is difficult to draw specific conclusions regarding trichloroethylene from the available studies because, in general, a small number of people were studied, exposure levels were not defined, exposure to other potentially harmful chemicals may have occurred at the same time and, in some cases, comparisons were not made to unexposed individuals.(1,9,22) In general, symptoms of CNS depression are commonly reported in employees exposed to average trichloroethylene levels of 100 ppm and above.(9) One limited study reported symptoms such as dizziness, headache, insomnia, and altered mood in a small number of employees exposed to up to 40 ppm.(25)

Nerves of the face and head (cranial nerves) have been affected by long-term exposure to trichloroethylene or chemicals formed when it decomposes. In particular, the trigeminal nerve, which provides feeling and movement to part of the face, has been affected. To a lesser extent, the optic nerve, which provides sight, has also been affected.

In one study, some evidence of trigeminal nerve impairment was seen in employees with long-term exposure to no more than 35 ppm.(1) Evidence of trigeminal nerve damage was also observed in employees with long-term occupational exposure to approximately 40 ppm.(25) Effects were more pronounced with longer exposures. Several other studies, with higher exposures, have also reported trigeminal nerve effects. Symptoms such as facial numbness, jaw weakness, altered reflexes and facial discomfort have been reported.(1,7,9) In one study, trigeminal nerve disorders were not observed in employees with long-term exposure to 38 to 172 ppm.(1)

Vision disturbances, including blurred, double or tunnel vision and poor eyesight, have occasionally been reported following long-term exposure. These effects are caused by impairment of the optic nerve and other cranial nerves. (1,7,19)

The trigeminal and optic nerve effects may be caused by dichloroacetylene, a chemical formed when trichloroethylene decomposes in the presence of strong alkaline materials. (1,7,9,19)

A metal degreaser exposed to 1.5 to 32 ppm for 1 to 2 hours/day for over 20 years experienced loss of feeling in hands and feet persisting for 4 years after retirement. This individual also had several high level short-term exposures which may have contributed to his symptoms. Repeated skin contact (while cleaning contact lenses) resulted in a reduced sense of touch, decreased mobility of the fingers, and an inability to grasp small objects with thumb and forefinger. These effects were reversible after several months. (1,19)

#### SKIN :

Repeated or prolonged contact can cause dry, red and chapped skin (dermatitis). (8,22)

#### SKIN SENSITIZATION :

A few case reports have described severe redness and irritation of the skin following relatively short exposures (up to 5 weeks) to unspecified or high vapour concentrations (up to 165 ppm). In most cases, impaired liver function and exposure to several other potentially harmful chemicals were also reported. In one case, the person later tested positive in a patch test, suggesting this person was allergic to trichloroethylene. However, it cannot be concluded that trichloroethylene is a skin sensitizer based on this one positive patch test. (26,31,32)

#### HEART/BLOOD VESSELS :

A number of studies have investigated the effects of occupational exposure to trichloroethylene on the heart. Many of the studies are limited by factors such as the small number of people studied and lack of exposure information. In general, the studies suggest that workplace exposures to 100 ppm may cause irregular heart beat in a small number of people occupationally exposed. (9,22)

#### KIDNEYS/URINARY SYSTEM :

There is limited evidence that exposure to trichloroethylene may cause kidney injury in some people following long-term occupational exposure. No firm conclusions can be drawn from the available studies because most only involved a very small number of exposed individuals, exposure levels were not defined and/or there may have been exposure to other potentially harmful chemicals. (1) Kidney effects were not observed following long-term occupational exposure at concentrations up to 40 ppm. (27)

#### LIVER :

There is limited evidence that exposure to trichloroethylene may cause liver injury in some people following long-term occupational exposure. No firm conclusions can be drawn from the available studies because most only involved a very small number of exposed individuals, exposure levels were not defined and/or there may have been exposure to other potentially harmful chemicals. (1) Liver effects were not observed following long-term occupational exposure at concentrations up to 40 ppm. (27)

#### HEARING :

Limited information suggests that long-term exposure may harm hearing. Concentrations which have produced hearing effects are probably high

enough to have also produced significant symptoms of central nervous system (CNS) depression. (9,22,23)

#### CARCINOGENICITY :

Trichloroethylene is probably a human carcinogen. Three well-designed studies of people with occupational exposure to trichloroethylene showed higher levels of liver and biliary tract cancers and non-Hodgkins lymphoma. (2) Numerous other studies were either negative or had significant limitations, including small sample size, limited exposure data and exposure to other chemicals. (2)

The International Agency for Research on Cancer (IARC) has concluded that there is limited evidence for the carcinogenicity of trichloroethylene in humans. IARC has also concluded that there is sufficient evidence that trichloroethylene is carcinogenic in experimental animals. (2)

The International Agency for Research on Cancer (IARC) has concluded that this chemical is probably carcinogenic to humans (Group 2A).

The American Conference of Governmental Industrial Hygienists (ACGIH) has designated this chemical as not suspected as a human carcinogen (A5). The US National Toxicology Program (NTP) has listed this chemical as reasonably anticipated to be a human carcinogen.

#### TERATOGENICITY AND EMBRYOTOXICITY :

Very limited human information does not indicate that occupational exposure to trichloroethylene is harmful to the unborn child. One study did not show more birth defects in the children of men occupationally exposed to trichloroethylene. (1,30) There is some evidence that exposure to trichloroethylene in drinking water may cause certain types of birth defects. Although the available information is far from conclusive. (1)

The available animal information does not suggest that trichloroethylene causes developmental effects. Most studies have not shown harmful effects in the offspring or have shown effects, but only in the presence of significant toxicity in the mothers

#### REPRODUCTIVE TOXICITY :

It is not possible to conclude that occupational exposure to trichloroethylene causes harmful effects on reproductive function in men or women, based on the limited human information available. In a small-scale study, trichloroethylene and chemicals formed when trichloroethylene breaks down in the body were observed in the seminal fluid of men occupationally exposed to trichloroethylene. In another study, sperm parameters (sperm density and motility) were unaffected in men occupationally exposed to trichloroethylene, but a low percentage of sperm with normal shape was observed. Animal studies suggest that exposure to relatively high concentrations of trichloroethylene may produce effects on sperm, including reduced motility, changes in sperm shape and reduced sperm count. However, well-conducted studies have not shown reduced fertility following trichloroethylene exposure.

No changes in sperm count or sperm shape were observed in 15 men occupationally exposed to trichloroethylene for more than 20 hours/week. The exposed group had a small, but non-significant change, in mature spermatozoa, which may indicate Y-chromosomal non-disjunction. (1,2,30) Eight mechanics were selected from a group that had sought medical consultation for fertility problems. Exposure to trichloroethylene had occurred for at least 2 years, during cleaning and degreasing operations. All eight men had been diagnosed as infertile. Trichloroethylene and some of its breakdown products were detected in the seminal fluid samples of all eight men, while none were detected in the seminal fluid of 5 men who did not work with trichloroethylene. (50)

This study is limited by factors such as the very small number of men studied, sperm parameters were not assessed and other potential causes of infertility were not evaluated.

In another study, analysis of semen samples from 85 male workers who were exposed to approximately 30 ppm trichloroethylene showed that the majority had normal semen volume, sperm density and motility. Exposed workers had a low percentage of normal sperm morphology (statistical significance not reported). Workers were divided into a "low exposure" and "high exposure" groups. There were no significant differences in mean sperm parameters, except sperm density. However, in both groups, sperm density was approximately double the World Health Organization standard normal sperm density.(49) In another study, increased miscarriages were not observed in the partners of men occupationally exposed to trichloroethylene.(2,30)

Some studies with women occupationally exposed to trichloroethylene have shown a slight increased frequency of miscarriages, while others have not.(1,2) It is not possible to draw firm conclusions from these studies due to factors such as the lack of exposure information, self-reporting biases and concurrent exposure to other potentially harmful chemicals.

#### MUTAGENICITY :

Trichloroethylene is considered mutagenic based on animal information. It is not possible to draw conclusions from mutagenicity studies of people with occupational exposure to trichloroethylene. Mutagenicity has been observed in some studies, but not in others. The studies had design limitations, including multiple chemical exposures and possible confounding factors such as smoking.(1,2) Positive results were obtained in the somatic cells of animals exposed to trichloroethylene with a purity of greater than 99%, using relevant routes of exposure.

#### TOXICOLOGICALLY SYNERGISTIC MATERIALS :

When ethanol (commonly found in alcoholic beverages) is consumed shortly before or after exposure to trichloroethylene, the skin of the face and arms becomes very red. This condition is called "degreaser's flush".(1,8)

#### POTENTIAL FOR ACCUMULATION :

Trichloroethylene is rapidly absorbed into the bloodstream following inhalation and ingestion and rapidly distributed to organs, including the liver, kidneys and cardiovascular and nervous systems. A small amount is absorbed through the skin. Some trichloroethylene is eliminated unchanged and as carbon dioxide in exhaled breath. Some trichloroethylene is broken down in the body mainly to trichloroacetic acid and trichloroethanol, which are excreted primarily in the urine. Trichloroethylene is excreted from the body at a moderate rate, mostly in the urine.(1,22,28)

#### HEALTH COMMENTS :

A number of studies have looked at health effects in human populations exposed to trichloroethylene in drinking water. For the most part, these studies have not been evaluated in this review due to difficulties with interpretation and their relevance to occupational exposures. Unstabilized trichloroethylene can decompose in the presence of air, light, heat, strong alkaline materials, and certain metals. Chemicals formed as a result of decomposition include phosgene, hydrogen chloride, and dichloroacetylene. These chemicals may contribute to or cause some of the harmful effects reported in workplaces where trichloroethylene was handled.(1,7,9,22,29)

**INHALATION :**

Take proper precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment). Remove source of contamination or move victim to fresh air. If breathing has stopped, trained personnel should begin artificial respiration (AR) or, if heart has stopped, cardiopulmonary resuscitation (CPR) immediately. Immediately transport victim to an emergency care facility.

**SKIN CONTACT :**

Avoid direct contact. Wear chemical resistant protective clothing if necessary. As quickly as possible, remove contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Quickly and gently blot or brush away excess chemical. Wash gently and thoroughly with water and non-abrasive soap for 20 minutes or until the chemical is removed. Obtain medical attention immediately. Completely decontaminate clothing, shoes and leather goods before re-use or discard.

**EYE CONTACT :**

Avoid direct contact. Wear chemical resistant gloves, if necessary. Quickly blot or brush away excess chemical. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 20 minutes or until the chemical is removed, while holding the eyelid(s) open. Obtain medical attention immediately.

**INGESTION :**

NEVER give anything by mouth if victim is rapidly losing consciousness or is unconscious or convulsing. DO NOT INDUCE VOMITING. Have victim drink 240 to 300 mL (8 to 10 ozs) of water to dilute material in stomach. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Repeat administration of water. Obtain medical attention immediately.

**FIRST AID COMMENTS :**

Provide general supportive measures (comfort, warmth, rest). Consult a doctor and/or the nearest Poison Control Centre for all exposures except minor instances of inhalation or skin contact. All first aid procedures should be periodically reviewed by a doctor familiar with the material and its condition of use in the particular workplace.

**NOTE TO PHYSICIANS :**

Trichloroethylene decomposes to other toxic chemicals such as phosgene, dichloroacetylene and hydrogen chloride. Refer to Section 10 "Stability and Reactivity" for information on conditions which may lead to the formation of these chemicals. Depending on the circumstances in your workplace, it may be necessary to develop first aid procedures which also consider the effects of these chemicals.

**\*\*\* SECTION 5. FIRE FIGHTING MEASURES \*\*\***

**FLASH POINT :**

None measured by conventional test methods. High concentrations of vapour mixed with air can be ignited by high-energy sources. (29,37)

**LOWER FLAMMABLE (EXPLOSIVE) LIMIT (LFL/LEL) :**

8.0% at 25 deg C (1,37); 7.8% at 100 deg C (continuous contact with ignition source) (37)

**UPPER FLAMMABLE (EXPLOSIVE) LIMIT (UFL/UEL) :**

Saturation vapour concentration (9.74% at 25 deg C) (29); 52% at 100 deg C (continuous contact with ignition source) (37)

**AUTOIGNITION (IGNITION) TEMPERATURE :**

420 deg C (788 deg F) (37)

**SENSITIVITY TO MECHANICAL IMPACT :**

Probably not sensitive; stable material.

**SENSITIVITY TO STATIC CHARGE :**

Liquid can accumulate static charge by flow or agitation due to its low electrical conductivity (800 pS/m).(38) Probably not sensitive to static discharge because of large amount of energy required for ignition.

**COMBUSTION AND THERMAL DECOMPOSITION PRODUCTS :**

Hydrogen chloride gas, phosgene and other toxic and irritating compounds, such as chlorine and dichloroacetyl chloride.(29,39)

**FIRE HAZARD SUMMARY :**

Trichloroethylene is not flammable under most conditions of use. However, it can probably burn if strongly heated (high temperatures and a strong flame). No flash point has been measured by standard tests. However, under certain circumstances (e.g. ignition by a high-energy source such as a welding arc or hot wire ignition), trichloroethylene can form combustible vapour-air mixtures. Therefore, in hot work situations trichloroethylene should be regarded as flammable. Addition of small quantities of combustible substances or increasing oxygen content significantly increases flammability. The liquid can accumulate static charge by flow or agitation. During a fire, irritating and toxic hydrogen chloride gas, chlorine and phosgene may be generated. Trichloroethylene can accumulate in low lying areas. Closed containers can explode if exposed to the heat of a fire or excess heat for a sufficient period of time.

**EXTINGUISHING MEDIA :**

Trichloroethylene is generally not flammable. Use extinguishing media suitable for surrounding fire.(37,39) If trichloroethylene is burning, use carbon dioxide, dry chemical powder, foam or water fog.(33)

**FIRE FIGHTING INSTRUCTIONS :**

Evacuate area and fight fire from a safe distance or a protected location. Approach fire from upwind to avoid hazardous vapours and toxic decomposition products.

If possible, isolate materials not yet involved in the fire, move containers from the fire area if this can be done without risk, and protect personnel. Otherwise, fire-exposed containers or tanks should be cooled by application of water spray. Application should begin as soon as possible and should concentrate on any unwetted portions of the container. Apply water from the side and from a safe distance until well after the fire is out. Stay away from the ends of tanks involved in the fire, but be aware that flying material from ruptured tanks may travel in any direction. Withdraw immediately in case of rising sound from venting safety device or any discolouration of tank due to fire. For a massive fire, it may be prudent to use unmanned hose holders or monitor nozzles.

If a leak or spill has not ignited, use water spray to disperse the vapours and to protect personnel attempting to stop a leak. Solid streams of water may be ineffective and spread material. Tanks or containers should not be approached directly after they have been involved in a fire or heated by exposure.

Trichloroethylene is a suspect carcinogen and its decomposition products are extremely toxic. Do not enter without wearing specialized protective equipment suitable for the situation. Firefighter's normal protective clothing (Bunker Gear) will not provide adequate protection. A full-body encapsulating chemical resistant suit with positive pressure self-contained breathing apparatus (MSHA/NIOSH approved or equivalent) may be necessary.

**\*\* NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD IDENTIFICATION\*\***

NFPA - HEALTH : 2 - Intense or continued (but not chronic)  
exposure could cause temporary incapacitation or possible residual  
injury.  
NFPA - FLAMMABILITY : 1 - Must be preheated before ignition can  
occur.  
NFPA - INSTABILITY : 0 - Normally stable, even under fire  
conditions, and not reactive with  
water.

**\*\*\* SECTION 6. ACCIDENTAL RELEASE MEASURES \*\*\***

**SPILL PRECAUTIONS :**

Restrict access to area until completion of cleanup. Ensure cleanup is conducted by trained personnel only. Provide adequate personal protective equipment. Ventilate area. Remove sources of heat or flame to prevent formation of hazardous decomposition products. Notify government environmental agencies if this material is released into the environment.

**CLEAN-UP :**

Do not touch spilled material. Stop or reduce leak if safe to do so. Prevent material entering waterways, sewers or confined spaces. Contain spill with earth, sand, or inert absorbent material which does not react with the spilled material. If it is feasible and can be done safely, remove liquid by pumps or vacuum equipment. Place in suitable, covered, labelled containers. Soak up remaining spilled material with inert absorbent material (e.g. dry sand). Do not use combustible materials such as saw dust as the absorbent material. Place contaminated absorbent material in suitable, covered, labelled containers. Flush area with water.

Contaminated absorbent may pose the same hazards as the spilled product.

LARGE SPILLS: Contact police, emergency services and supplier for advice.

**\*\*\* SECTION 7. HANDLING AND STORAGE \*\*\***

**HANDLING :**

This material is a VERY TOXIC liquid (MUTAGEN, SKIN/EYE IRRITANT and SUSPECT CANCER HAZARD). Before handling, it is extremely important that engineering controls are operating and that protective equipment requirements and personal hygiene measures are being followed. People working with this chemical should be properly trained regarding its hazards and its safe use. Maintenance and emergency personnel should be advised of potential hazards.

If trichloroethylene is released, immediately put on a suitable respirator and leave the area until the severity of the release is determined. In case of leaks or spills, escape-type respiratory protective equipment should be available in the work area.

Immediately report leaks, spills or ventilation failures.

Unprotected persons should avoid all contact with this chemical including contaminated equipment.

Closed handling systems for processes involving this material should be used. If a closed handling system is not possible, use in smallest possible amounts in well-ventilated area, separate from the storage area. Avoid generating vapours or mists. Prevent the release of vapours/mist into the workplace air.

Any use of this material in an elevated temperature process should be thoroughly evaluated to determine safe operating conditions. Do not use near welding operations, flames or hot surfaces because of the risk of formation of toxic hydrogen chloride or phosgene. Do not perform any welding, cutting, soldering, drilling or other hot work on an empty vessel, container or piping until all liquid and vapours have been cleared. Follow the chemical supplier/manufacturer's advice regarding checking and maintaining appropriate levels of stabilizers.

Do not use with incompatible materials such as strong bases (e.g. sodium hydroxide) and alkali metals (e.g. sodium and its alloys). See Incompatibilities - Materials to Avoid section for more information.

Never return contaminated material to its original container.

Inspect containers for leaks before handling. Stand upwind of all opening, pouring and mixing operations. Prevent damage to containers. Label containers. Open containers on a stable surface. Keep containers tightly closed when not in use. Assume that empty containers contain residues which are hazardous.

Never return contaminated material to its original container. Keeping work areas clean is essential. Use work surfaces that can be easily decontaminated.

Follow handling precautions on Material Safety Data Sheet. Have suitable emergency equipment for fires, spills and leaks readily available.

Practice good housekeeping. Maintain handling equipment. Comply with applicable regulations.

#### STORAGE :

Store in a cool, dry, well-ventilated area, out of direct sunlight and away from heat and ignition sources.

Keep quantity stored as small as possible.

Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Keep storage area separate from work areas, eating areas and protective equipment storage. Post warning signs. Inspect periodically for damage or leaks.

Store away from incompatible materials, such as strong bases (e.g. sodium hydroxide) and alkali metals (e.g. sodium and its alloys). See Incompatibilities - Materials to Avoid section for more information. Inspect all incoming containers to make sure they are properly labelled and not damaged. Store in suitable, unbreakable, labelled containers (usually the shipping container). Store containers at a convenient height for handling, below eye level if possible. Keep containers tightly closed when not in use. Inspect containers regularly for leakage or expired shelf life. Replace defective containers. Have replacement containers and labels on hand. Protect from damage. Keep empty containers in separate storage area. Empty containers may contain hazardous residues. Keep closed.

Storage facilities should be made of fire-resistant materials. Have appropriate fire extinguishers and spill clean-up equipment in storage area. Contain spills or leaks by storing in trays made from compatible materials. Keep absorbents for leaks and spills readily available. Provide raised sills or ramps at doorways or create a trench which drains to a safe location.

Floors should be sealed to prevent absorption.

Follow any special instructions for storage on Material Safety Data Sheet (e.g. maximum storage quantities). Store within temperature range recommended by chemical manufacturer/supplier.

Avoid bulk storage indoors. Store in isolated fireproof building, if possible. Storage tanks should be above ground, over an area sealed on the bottom and diked to hold entire contents.

\*\*\* SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION \*\*\*

NOTE : Exposure to this material can be controlled in many ways. The measures appropriate for a particular worksite depend on how this material is used and on the extent of exposure. This general information can be used to help develop specific control measures. Ensure that control systems are properly designed and maintained. Comply with occupational, environmental, fire, and other applicable regulations.

SAMPLING AND ANALYSIS :

Use appropriate instrumentation and sampling strategy (location, timing, duration, frequency, and number of samples). Interpretation of the sampling results is related to these variables and the analytical method. Sampling should be carried out by trained personnel.

OSHA METHOD No 07 - Organic vapours including trichloroethylene. OSHA analytical methods manual. 2nd ed. Part 1. Vol. 1. US Dept of Labor, January 1990. Fully validated method. Collection on coconut shell activated charcoal sorbent tube. Desorption with carbon disulfide (CS<sub>2</sub>). Analysis by gas chromatography using flame ionization detector (FID).  
NIOSH METHOD 1022 - NIOSH manual of analytical methods. 4th ed. Vol. 3. Partially evaluated method. Collection on coconut shell activated charcoal sorbent tube. Desorption with carbon disulfide (CS<sub>2</sub>). Analysis by gas chromatography using flame ionization detector (FID). Detection limit of 0.01 mg (estimated).

NIOSH METHOD 3701 - NIOSH manual of analytical methods. 4th ed. Vol. 3. Fully evaluated method. Collection in airbag (Tedlar). Analysis by gas chromatography (portable) using photoionization detector (PID). Detection limit of 0.1 ppm (estimated).

DIRECT READING INSTRUMENTS: Methods of detection in commercially available devices which may be suitable: Infrared photometer, photoionization analyzer, gas chromatograph analyzer.

COLORIMETRIC DETECTOR TUBES: Commercially available.

ENGINEERING CONTROLS :

Engineering control methods to reduce hazardous exposures are preferred. Methods include mechanical ventilation (dilution and local exhaust), process or personnel enclosure, control of process conditions and process modification (e.g. substitution of a less hazardous material). Administrative controls and personal protective equipment may also be required.

Because of the high potential hazard associated with this substance, stringent control measures such as enclosure or isolation may be necessary. A closed system should be considered for handling this material. A totally enclosed, intrinsically safe system with an associated purging system should be considered for unloading bulk material and sampling process liquids. To prevent the release of this material due to equipment failure, backup controls (e.g. double mechanical seals for process pumps) should be considered.

Any use of this material in an elevated temperature process should be thoroughly evaluated to determine safe operating conditions.

Use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Exhaust directly to the outside, taking necessary precautions for environmental protection.

Supply sufficient replacement air to make up for air removed by exhaust

systems.

PERSONAL PROTECTIVE EQUIPMENT :

If engineering controls and work practices are not effective in controlling exposure, then wear suitable personal protection equipment, including approved respiratory protection. Have appropriate respiratory protection available for use in emergencies such as spills or fire.

If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection. Refer to the CSA Standard Z94.4-93, "Selection, Use and Care of Respirators," available from the Canadian Standards Association, Rexdale, Ontario, M9W 1R3.

RESPIRATORY PROTECTION GUIDELINES :

NIOSH RECOMMENDATIONS FOR TRICHLOROETHYLENE CONCENTRATIONS IN AIR (45):

AT CONCENTRATIONS ABOVE THE NIOSH REL, OR WHERE THERE IS NO REL, AT ANY DETECTABLE CONCENTRATION: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

ESCAPE: Gas mask with organic vapour canister; or escape-type SCBA.

NOTE: The IDLH concentration is 1000 ppm. Carcinogenic effects of this compound were not considered in determining the IDLH value.

The purpose of establishing an IDLH value is to ensure that the worker can escape from a given contaminated environment in the event of failure of the most protective respiratory protection equipment. In the event of failure of respiratory protective equipment every effort should be made to exit immediately.

NOTE: NIOSH has classified this material as a potential occupational carcinogen, according to specific NIOSH criteria, with no recommended exposure limit (REL). This classification is reflected in these recommendations for respiratory protection, which specify that only the most reliable and protective respirators be worn at any detectable concentration. The requirements in Canadian jurisdictions may vary.

The respirator use limitations specified by the approving agency and the manufacturer must be observed.

Recommendations apply only to NIOSH approved respirators.

Air-purifying respirators do not protect against oxygen-deficient atmospheres.

ABBREVIATIONS: SAR = supplied-air respirator; SCBA = self-contained breathing apparatus. IDLH = Immediately Dangerous to Life or Health.

EYE/FACE PROTECTION :

Chemical safety goggles suitable for splash protection and/or a face shield.

SKIN PROTECTION :

Chemical protective gloves, coveralls, boots, and/or other resistant protective clothing.

RESISTANCE OF MATERIALS FOR PROTECTIVE CLOTHING :

Guidelines for trichloroethylene (46):

RECOMMENDED (resistance to breakthrough longer than 8 hours): Polyvinyl alcohol, Viton (TM), Viton(TM)/Butyl rubber, Barrier (PE/PA/PE), Silver Shield/4H(TM) (polyethylene/ethylene vinyl alcohol), Trelchem(TM) HPS, Tychem(TM) BR/LV, Tychem(TM) TK.

RECOMMENDED (resistance to breakthrough longer than 4 hours): Responder (TM).

NOT RECOMMENDED for use (resistance to breakthrough less than 1 hour):  
Butyl rubber, natural rubber, neoprene rubber, nitrile rubber,  
polyethylene, polyvinyl chloride, Tychem(TM) SL.

Recommendations are valid for permeation rates reaching 0.1ug/cm2/min  
or 1 mg/m2/min and over.

Resistance of specific materials can vary from product to product.  
Breakthrough times are obtained under conditions of continuous contact,  
generally at room temperature. Evaluate resistance under conditions of  
use and maintain clothing carefully.

PERSONAL HYGIENE :

Have a safety shower and eye-wash fountain readily available in the work  
area for emergency use. Keep contaminated clothing in closed containers.  
Inform laundry personnel of contaminant's hazards. Do not eat, drink or  
smoke in work area.

\*\* EXPOSURE GUIDELINES \*\*

\* THRESHOLD LIMIT VALUES (TLVs) / AMERICAN CONFERENCE OF  
GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH) / 2003 \*

TIME-WEIGHTED AVERAGE (TLV-TWA) : 50 ppm - Carcinogenicity Designation A5

SHORT-TERM EXPOSURE LIMIT (TLV-STEL) :

100 ppm - Carcinogenicity Designation A5

TLV BASIS - CRITICAL EFFECT(S) : CNS - central nervous system  
Headache  
Liver

TLV DEFINITIONS :

CARCINOGENICITY DESIGNATION A5 - Not suspected as a Human Carcinogen:  
Substance is not suspected to be a human carcinogen on the basis of  
properly conducted human studies. Negative evidence of carcinogenicity  
in laboratory animals will be considered if it is supported by other  
relevant data.

TLV COMMENTS :

BIOLOGICAL EXPOSURE INDICES (BEIs): The ACGIH has adopted a BEI for this  
chemical. BEIs provide an indication of worker exposure by measuring the  
chemical or its breakdown products in the body or by measuring  
biochemical changes resulting from exposure to the chemical. Consult the  
BEI documentation for further information.

NOTE: In many jurisdictions, exposure limits are similar to the ACGIH  
TLVs. Since the manner in which exposure limits are established,  
interpreted, and implemented can vary, obtain detailed information from  
the appropriate government agency in each jurisdiction.

\* PERMISSIBLE EXPOSURE LIMITS (PELs) / FINAL RULE LIMITS /  
US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) \*

TIME-WEIGHTED AVERAGE (PEL-TWA) : 50 ppm

SHORT-TERM EXPOSURE LIMIT (PEL-STEL) :

200 ppm

NOTE: The OSHA PEL Final Rule Limits are currently  
non-enforceable due to a court decision. The OSHA  
PEL Transitional Limits are now in force.

\* PERMISSIBLE EXPOSURE LIMITS (PELs) / TRANSITIONAL LIMITS /  
US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) \*

TIME-WEIGHTED AVERAGE (PEL-TWA) : 100 ppm

CEILING EXPOSURE LIMIT (PEL-C) : 200 ppm

TRANSITIONAL LIMIT PEL COMMENTS :

Acceptable maximum peak above the acceptable ceiling concentration for  
an 8-hour shift: 300 ppm (5-minute maximum duration in any 2 hours).  
These Permissible Exposure Limits are taken from 29 CFR 1910.1000 Table  
Z - 2.

\* EMERGENCY RESPONSE PLANNING GUIDELINES (ERPGs) /  
AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA) / 2003 \*

ERPG-1 : 100 ppm

ERPG-2 : 500 ppm

ERPG-3 : 5000 ppm

The ERPG-1 is the maximum airborne concentration below which it is  
believed that nearly all individuals could be exposed for up to  
1 hr without experiencing other than mild transient adverse health  
effects or perceiving a clearly defined, objectionable odor.

The ERPG-2 is the maximum airborne concentration below which it is  
believed that nearly all individuals could be exposed for up to  
1 hr without experiencing or developing irreversible or other  
serious health effects or symptoms which could impair an  
individual's ability to take protective action.

The ERPG-3 is the maximum airborne concentration below which it is  
believed that nearly all individuals could be exposed for up to  
1 hr without experiencing or developing life-threatening health  
effects.

NOTE : Users of the ERPG values are strongly encouraged to consult  
the documentation before use.

\*\*\* SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES \*\*\*

MOLECULAR WEIGHT : 131.39

CONVERSION FACTOR :

1 ppm = 5.36 mg/m<sup>3</sup>; 1 mg/m<sup>3</sup> = 0.186 ppm at 25 deg C (calculated)

MELTING POINT : Reported values vary; -73 deg C (-99.4 deg F)  
(2,33); -86.5 deg C (-124  
deg F) (29,33)

BOILING POINT : 87 deg C (189 deg F) (1,2,29,33)

RELATIVE DENSITY (SPECIFIC GRAVITY) :

1.464 at 20 deg C (water=1) (2,29)

SOLUBILITY IN WATER :

Slightly soluble (0.11 g/100 g at 20 deg C) (1,29,40)

SOLUBILITY IN OTHER LIQUIDS :

Soluble in all proportions in ethanol, acetone, diethyl ether,  
chloroform, fixed and volatile oils, and most common organic  
solvents. (1,22,40)

COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT) :

Log Poct = 2.42 (1); log Poct = 2.61 (2)

pH VALUE	: Not available
VISCOSITY-DYNAMIC (29,40)	: 0.57 mPa.s (0.57 centipoise) at 20 deg C
VISCOSITY-KINEMATIC (calculated)	: 0.39 m <sup>2</sup> /s (0.39 centistokes) at 20 deg C
SURFACE TENSION	: 29.3 mN/m (29.3 dynes/cm) at 20 deg C (29)
VAPOUR DENSITY	: 4.53 (air=1) (2,41)
VAPOUR PRESSURE (74 mm Hg) at 25 deg C (1)	: 8 kPa (60 mm Hg) at 20 deg C (33); 9.87 kPa
SATURATION VAPOUR CONCENTRATION 97400 ppm (9.74%) at 25 deg	: Approximately 79000 ppm (7.9%) at 20 deg C; C (calculated)
EVAPORATION RATE acetate= 1) (41); 3.1	: 4.9 (n-butyl acetate = 1) (42); 3.0 (n-butyl (diethyl ether = 1) (42)
CRITICAL TEMPERATURE	: 298-300 deg C (568.4-572 deg F) (29,40)
CRITICAL PRESSURE (36)	: 4985 kPa (49.2 atm) (29); 5020 kPa (49.5 atm)

### \*\*\* SECTION 10. STABILITY AND REACTIVITY \*\*\*

#### STABILITY :

Moderately stable. Trichloroethylene is decomposed slowly by air forming phosgene, hydrogen chloride and dichloroacetyl chloride. Sunlight (especially ultraviolet light), heat and moisture accelerate this reaction. In the presence of water, corrosive dichloroacetic acid and hydrochloric acid are formed. (1,22,29,36)

#### HAZARDOUS POLYMERIZATION :

Does not occur. The liquid can be polymerised by irradiation with cobalt 60 gamma rays or X-rays. (29)

#### INCOMPATIBILITY - MATERIALS TO AVOID :

ALKALI METALS (e.g. sodium or potassium and its alloys) - Mixtures are shock-sensitive and may explode with great violence on light impact. Forms spontaneously explosive and flammable monochloroacetylene or dichloroacetylene. (37,43)

STRONG BASES (e.g. sodium hydroxide or potassium hydroxide) or EPOXIDES (e.g. 1-chloro-2,3-epoxypropane and catalytic amounts of halide ions) - decompose trichloroethylene forming spontaneously explosive and flammable dichloroacetylene gas. (29,43)

STRONG OXIDIZING AGENTS (e.g. dinitrogen tetroxide, nitric acid, perchloric acid, oxygen, or peroxides) or STRONG REDUCING AGENTS (e.g. phosphorus, tin (II) chloride, metal hydrides) - may react violently with risk of fire and explosion. (22,29,33,37,39,43)

CHEMICALLY ACTIVE METALS (e.g. granular barium, lithium shavings, or beryllium, magnesium or titanium powder) - can ignite or explode violently. (37,43)

COPPER - can react with any dichloroethylenes present as an impurity, to form explosive acetylides. (36)

ALUMINUM POWDER - may react violently with ignition if traces of hydrochloric acid are present. (37,43)

ALUMINUM CHLORIDE - speeds up the polymerization of trichloroethylene, with production of hydrochloric acid and a very high release of heat. (37,43)

POTASSIUM NITRATE - may react violently. (22,43)

IRON, COPPER, ZINC or ALUMINUM - forms phosgene at 250-600 deg C. (35)

#### HAZARDOUS DECOMPOSITION PRODUCTS :

Hydrogen chloride gas, hydrochloric acid, phosgene, dichloroacetyl

chloride and dichloroacetic acid.

CONDITIONS TO AVOID :

Excessive heat, open flames, sparks, electrical arcs, welding arcs, hot surfaces or other high temperature sources, sunlight, moisture, depletion of stabilizers.

CORROSIVITY TO METALS :

Pure, dry, stabilized trichloroethylene is not corrosive to steel, cast iron, stainless steels, aluminum or nickel and its alloys.

Trichloroethylene may attack aluminum, zinc and their alloys when it is unstabilized, uninhibited or lightly inhibited, heated or in the presence of water. No specific information is available on the corrosion rates. It can also attack brass and lead. (33,44)

STABILITY AND REACTIVITY COMMENTS :

Trichloroethylene stabilizers are stable to 130 deg C in the presence of air, moisture, light and construction metals. Stabilizers become less effective at higher temperatures. (22)

\*\*\* SECTION 11. TOXICOLOGICAL INFORMATION \*\*\*

LC50 (rat): Approximately 8000 ppm (4-hour exposure) (5); 12500 ppm (4-hour exposure) (20)

LC50 (mouse): 8450 ppm (4-hour exposure) (3)

LD50 (oral, rat): 7200 mg/kg (cited as 4.92 mL/kg) (5)

LD50 (oral, male mouse): 2402 mg/kg (4)

LD50 (dermal, rabbit): Greater than 29000 mg/kg (cited as greater than 20 mL/kg) (5)

EYE IRRITATION : Trichloroethylene is a severe eye irritant.

Application of 0.1 mL of undiluted trichloroethylene caused severe injury in rabbits (scored over 5 where 5 is severe injury; graded 4/10). (5) In another study, application of undiluted trichloroethylene caused mild irritation in rabbits (scored 9/110). (6)

Rabbits and guinea pigs exposed to 300-500 ppm trichloroethylene vapour over 6 weeks did not show signs of eye irritation. (7)

SKIN IRRITATION : Trichloroethylene is a severe skin irritant.

In an OECD-compliant test, application of 0.5 mL of trichloroethylene (greater than 99.95% pure) produced severe irritation in rabbits (primary irritation index: of 5.44/8; maximum average scores: 4/4 erythema and 2/4 edema at day 1). (55) Application of 0.01 mL of undiluted trichloroethylene (greater than 99.5% pure) produced severe irritation in rabbits (graded 5/10). (5) In a Draize test, application of undiluted trichloroethylene caused severe skin irritation in rabbits (scored 5.2/8). (6)

EFFECTS OF SHORT-TERM (ACUTE) EXPOSURE : Signs of central nervous system (CNS) depression, such as incoordination and unconsciousness, have been observed in animals following inhalation or ingestion of high doses. (1,8,9,22) Reversible behavioural effects (e.g. avoidance behaviours) have been observed in rats exposed by inhalation to 200 ppm and above. (1,9)

Kidney injury has been observed in rats exposed by inhalation to 1000 ppm or higher for less than 1 day. Kidney effects were not observed in mice and rats exposed by ingestion to up to 2400 mg/kg/day for 3 weeks. (1) Reversible liver changes (e.g. increased liver weight) have been observed in mice, gerbils and rats exposed by inhalation to up to 300 ppm for 30 days. Slight liver effects have also been observed in rats

exposed to 10000 ppm for 1 hour or 100 ppm for 6 hours. Liver injury (e.g. inflammation and tissue death) has been observed in mice that ingested 600 mg/kg/day for 4 weeks. Similar effects were not seen in male rats that ingested 1100 mg/kg/day for 3 weeks.(1,9) A few studies have reported harmful effects on hearing in rats in the mid- frequency range. High exposures were used in these studies (1000-4000 ppm) and it appears that exposures of 2000 ppm or higher are necessary to produce effects.(1,23) Sensitization of the heart to injected adrenaline has been observed in dogs and rabbits exposed by inhalation to very high concentrations (3000 to 10000 ppm) for up to 1 hour.(1,8,9)

EFFECTS OF LONG-TERM (CHRONIC) EXPOSURE : Rats have survived inhalation exposures of up to 2000 ppm for up to 6 months. The only harmful effects noted were signs of central nervous system (CNS) depression. Harmful effects were not observed in rats following exposure to 1000 ppm for 90 days or 770 ppm for 6 weeks, nor in monkeys exposed to 400 ppm for 7 months.(1,9) CNS effects have also been observed in animals following ingestion of large doses (e.g. 5600 mg/kg for 6 weeks).(9) Some studies have shown liver effects occasionally at 400-500 ppm, but more commonly at near lethal concentrations (approximately 3000 ppm). In one study, liver damage was observed in rats exposed to 372 ppm for 120 days.(9) Liver effects are generally not seen at lower concentrations.(1) Increased liver weights were observed in mice that ingested up to 800 mg/kg/day for 4 to 6 months.(8) Mice exposed by inhalation to 100, 300 or 600 ppm for 78 weeks had increased incidence of enlarged kidney cells at the two highest concentrations.(2) The kidney is a target organ in long-term feeding studies involving the administration of high doses to rats and mice.(1,2) In one study, enlarged kidney cells and kidney damage was observed in rats exposed to 500 or 1000 mg/kg/day for 103 weeks.(2) Rats exposed by inhalation to 2500 ppm for 13 weeks showed hearing loss in the mid-frequency range.(1)

CARCINOGENICITY : The International Agency for Research on Cancer (IARC) has determined that there is sufficient evidence for the carcinogenicity of trichloroethylene in experimental animals. In two mouse feeding studies, significant increases in liver tumours were observed. In two rat feeding studies, kidney tumours were increased in male rats, and in one study, testicular tumours were increased. In mouse inhalation studies, an increased incidence of lymphomas was reported in one study, an increased incidence of liver tumours in one study, and increased incidences of lung tumours in three studies. In rat inhalation studies, an increased incidence of testicular tumours was observed in one study. Other studies were negative, or inconclusive due to limitations in study design.(2)

TERATOGENICITY, EMBRYOTOXICITY and/or FETOTOXICITY : The available information does not suggest that trichloroethylene causes developmental effects. Most studies have either not shown harmful effects in the offspring or have shown effects only in the presence of significant toxicity in the mothers.(1,2,8) Significant developmental effects were not observed in rats or mice exposed to trichloroethylene in a continuous breeding study.(54) Conclusions cannot be drawn from a study that showed delayed skeletal development (fetotoxicity) in the offspring of mothers exposed to high concentrations (1800 ppm) by inhalation. Effects were not observed in

another group similarly exposed.(11) Maternal toxicity, as measured by weight gain and biochemical tests, was not reported, but central nervous system depression would be expected at the concentration used. In a limited study, abnormal heart development was reported in the offspring of rats exposed to 1100 ppm (estimated dose 100 mg/kg/day) in drinking water throughout pregnancy. There was no evidence of toxicity in the mothers.(10) This study is limited because the number of mothers/group was not specified, but was probably less than ten, based on the total number of females used. In addition, the trichloroethylene was mixed with tap water, which could have resulted in exposure of the mothers to other potentially harmful chemicals, and the purity of the trichloroethylene was not specified. In other studies, maternal toxicity was not evaluated and, therefore, these studies are not included in this review.

REPRODUCTIVE TOXICITY : While some reproductive effects have been observed (e.g. abnormal sperm shape, reduced sperm motility), trichloroethylene has not been shown to reduce fertility in animals. A well-conducted continuous breeding study suggests that trichloroethylene is not a selective reproductive toxin. In mice, liver, kidney and lactational toxicity was more severe than the relatively moderate reductions in sperm motility. In rats, trichloroethylene produced general toxicity (reduced body weight, increased relative liver weight and kidney weights), with minimal effect on reproductive indices. In a 2-generation continuous breeding study, mice were exposed to 0.15, 0.30 or 0.60% trichloroethylene (purity not specified) microencapsulated in a gelatin and sorbitol shell and added to the diet. Reported doses were 100, 300 or 700 mg/kg/day. Statistically significant effects were noted at the high dose only. In adult animals in both generations, there was evidence of liver damage (increased liver weight and centrilobular hypertrophy). In second-generation adults, evidence of kidney injury (increased weight and renal tubular degeneration) was observed. There was a 4% reduction in pup weight in the first generation. Maternal exposure during lactation was associated with a significant increase in perinatal mortality (61%). Reduced testis and prostate weights and reduced sperm motility were observed in the first-generation males. Increased epididymis weight, decreased sperm motility and an increased proportion of abnormal sperm were noted in second-generation males. However, there were no measurable effects on fertility.(54)

In a related study, rats were exposed to 0.15, 0.30 and 0.60% trichloroethylene (purity not specified) microencapsulated in a gelatin and sorbitol shell and added to the diet. Reported doses were 76, 156 or 289 mg/kg/day. Adult female body weight was reduced at all doses, in both generations. Male body weight was reduced at the high dose in the first generation and at all doses in the second generation. Kidney weights were increased in first generation males and females. Liver weights were increased in first generation, high dose males and females, in all exposed males in the second generation and in females at the two higher doses in the second generation. The number of live pups/litter was decreased at the two highest doses in the first generation. Absolute testis weight was reduced in all exposed groups in the second generation. Sperm morphology was altered in low dose males in the second generation.(54)

Male rats (6/group) were exposed to 376 ppm trichloroethylene (99% pure) for 12 or 24 weeks (4 hours/day; 5 days/week). A significant decrease in total epididymal sperm count, sperm motility, and serum testosterone

levels was observed at weeks 12 and 24. This authors report that mating of the exposed rats produced maximum infertility, as judged by reproductive efficiency, percent pre-implantation and post implantation losses and litter size. However, no details are provided for evaluation.(52,53)

Mice were exposed to a high concentration (1000 ppm) trichloroethylene (99% pure) for 4-19 days (6 hours/day; 5 days/week). Damage to the epididymis, as evidenced by sloughing of epithelial cells, was observed after 4 weeks exposure.(51)

Mice exposed by inhalation to 2000 ppm trichloroethylene (purity not specified) for 5 days (4 hours/day) had abnormally shaped sperm 28 days after exposure.(13) A dose-related increase in abnormally shaped sperm was also observed in mice exposed by inhalation to 100 or 500 ppm trichloroethylene (99.9% pure) for 5 days (7 hours/day).(18)

The

biological significance of these observations is not clear. Rats exposed orally to up to 1000 mg/kg/day trichloroethylene (greater than 99.9% pure) for 6 weeks had normal sperm count, motility and shape.(14) Negative results were obtained in a dominant lethality study where male mice were exposed by inhalation to 450 ppm for 24 hours and then mated.(2, unconfirmed)

Reproductive function was not affected in female rats exposed orally to up to 1000 mg/kg/day trichloroethylene (greater than 99.9% pure) or by inhalation to 1800 ppm trichloroethylene (99% pure with 0.2% epichlorohydrin) for 2 weeks prior to mating.(11,12)

**MUTAGENICITY** :Trichloroethylene has been extensively studied for potential mutagenicity. Interpretation of the results from these tests is complicated, because the purity of the test substance is not always specified. Commercial trichloroethylene formulations may contain stabilizers (e.g. epichlorohydrin), which are mutagenic. Studies with impure trichloroethylene are not considered in this assessment. Positive results have been obtained in the somatic cells of live animals exposed by appropriate routes of exposure to highly pure trichloroethylene. Therefore, trichloroethylene is considered mutagenic. A dose-related, statistically significant increase in micronuclei in bone marrow red blood cells was observed in mice exposed orally to two single doses of 375, 750, 1125, 1500, 2250 or 3000 mg/kg trichloroethylene (purity 99.5%).(16) The significance of this study is limited by the uncertainties of the scoring method used (micronuclei, including microbodies appearing to be of nuclear origin) and the unusually high frequency of micronucleated polychromatic erythrocytes in the control group. The micronucleus frequency in the untreated and vehicle control groups also differed significantly from each other.(58) Rats and mice were exposed to single 6-hour concentrations of 0, 5, 500 or 5000 ppm of reagent grade trichloroethylene (purity greater than 99%). A significant, dose-related increase in micronuclei was observed in rat bone marrow. At 5000 ppm, the increase was approximately 4-fold and was reproducible. Animal toxicity and cytotoxicity were observed at this concentration. No significant changes were observed in the mice. Groups of rats were also exposed to 0, 4, 50 or 500 ppm for 4 days (6 h/day). The number of micronuclei in bone marrow polychromatic erythrocytes was comparable to the 1-day study. However, the results were not statistically significant in this case due to an unusually high number of micronuclei in the control group.(15)

A dose-related increase in DNA single strand breaks was observed in the liver cells of male mice and male rats administered single oral doses of

epichlorohydrin-free trichloroethylene in Tween 80 in distilled water. Rats were dosed with 0, 510, 1500, 3010 or 3995 mg/kg (cited as 0, 3.9, 11.4, 22.9 or 30.4 mMol/kg). Mice were dosed with 0, 100, 760, 1500 or 3010 mg/kg (cited as 0, 0.76, 5.8, 11.4 or 22.9 mMol/kg). Statistically significant DNA strand breaks were observed at 3010 mg/kg and above for rats and 1500 mg/kg and above for mice. (17)

In a non-standard test, male rats were given a single oral dose of 525 mg/kg (cited as 4 mMol/kg) trichloroethylene (99.5% pure). The rats were partially nephrectomized and injected intravenously with folic acid to increase the proliferative activity of the kidney cells. No lethality or severe toxic effects were observed in the animals. A statistically significant increase in the average frequency of micronucleated kidney cells was observed. (57)

Mice were dermally exposed to 7, 14 or 28 g/kg trichloroethylene (plus 99% purity). Six days following single or repeated exposures, a statistically significant increase in aneuploid cells was observed in hematopoietic stem cells of the bone marrow. (56)

Negative results (DNA damage, micronuclei, or chromosomal aberrations) were reported in several other animal studies. (1,2,18)

In mice, effects on abnormal sperm shape were observed in two studies (13,18), but not in a third study (14). Although changes in sperm head shape may be genetically determined, it is uncertain whether they are due to genotoxicity or to other toxic effects. This effect can therefore not be taken as evidence of germ cell mutagenicity.

In general, negative results have been obtained in bacteria and cultured mammalian cells, but positive results have been obtained in some systems. (2)

## \*\*\* SECTION 12. ECOLOGICAL INFORMATION \*\*\*

NOTE : Inclusion of Ecological Information on an MSDS is optional under the US Hazard Communication Standard and the Canadian Controlled Products Regulations (WHMIS). In other jurisdictions, inclusion of Ecological Information may be a requirement. For specific requirements, contact the relevant regulatory authorities in the jurisdiction where the MSDS is intended to be used.

The American National Standard for Hazardous Industrial Chemicals - Material Safety Data Sheets - Preparation (ANSI 2400.1-1998) provides advice on data that could be included in this section, as well as ecotoxicological tests and issues.

Databases in CCOHS's CD-ROM and Web collection which contain useful Ecological Information include CESARS, HSDB(R) (Hazardous Substances Data Bank) and CHRIS (Chemical Hazards Response Information System).

## \*\*\* SECTION 13. DISPOSAL CONSIDERATIONS \*\*\*

Review federal, provincial and local government requirements prior to disposal. Incineration in a facility designed to burn chlorinated solvents may be acceptable.

## \*\*\* SECTION 14. TRANSPORT INFORMATION \*\*\*

\*\* CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG)

SHIPPING INFORMATION \*\*

SHIPPING NAME AND DESCRIPTION: TRICHLOROETHYLENE

UN NUMBER: UN1710

CLASS: 6.1

PACKING GROUP/RISK GROUP: III

SPECIAL PROVISIONS: ---

PASSENGER CARRYING ROAD/RAIL LIMIT: 60 kg or L

MARINE POLLUTANT: ---

NOTE: This information incorporates the Transportation of Dangerous Goods Regulations SOR/2001-286, effective October 1, 2003.

\*\* US DEPARTMENT OF TRANSPORT (DOT) HAZARDOUS MATERIALS SHIPPING INFORMATION (49 CFR) \*\*

HAZARDOUS MATERIAL DESCRIPTION AND PROPER SHIPPING NAME:

TRICHLOROETHYLENE

HAZARD CLASS OR DIVISION: 6.1

IDENTIFICATION NUMBER: UN1710

PACKING GROUP: III

NOTE : This information was taken from the US Code of Federal Regulations Title 49 - Transportation and is effective October 2003.

\*\*\* SECTION 15. REGULATORY INFORMATION \*\*\*

\*\* CANADIAN WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) \*\*

CCOHS WHMIS CLASSIFICATION :

D1B - Poisonous and infectious material - Immediate and serious effects  
- Toxic

D2A - Poisonous and infectious material - Other effects - Very toxic

D2B - Poisonous and infectious material - Other effects - Toxic

WHMIS HEALTH EFFECTS CRITERIA MET BY THIS CHEMICAL :

D1B - TDG class 6.1 packing group III - toxic - immediate

D2A - Carcinogenicity - very toxic - other

D2B - Eye irritation - toxic - other

D2B - Mutagenicity - toxic - other

D2B - Skin irritation - toxic - other

WHMIS INGREDIENT DISCLOSURE LIST :

Included for disclosure at 1% or greater. Meets criteria for disclosure at 0.1% or greater.

DETAILED WHMIS CLASSIFICATION ACCORDING TO CRITERIA :

CLASS A - COMPRESSED GAS : Does not meet criteria.

CLASS B - FLAMMABLE AND COMBUSTIBLE MATERIAL :

Does not meet criteria. Not flammable under normal conditions.

CLASS C - OXIDIZING MATERIAL : Does not meet criteria.

CLASS D - POISONOUS AND INFECTIOUS MATERIAL. DIVISION 1 - IMMEDIATE AND SERIOUS TOXIC EFFECTS : Meets criteria for "Toxic material".

Acute Lethality : Does not meet criteria. LC50 (mouse): 8450 ppm

(4-hour exposure); LD50 (oral, male mouse): 2402 mg/kg; LD50 (dermal, rabbit): greater than 29000 mg/kg.

Transportation of Dangerous Goods (TDG) : "Toxic"; class 6.1, packing

group III.

CLASS D - POISONOUS AND INFECTIOUS MATERIAL. DIVISION 2 - OTHER TOXIC EFFECTS : Meets criteria for both "Very toxic material" and "Toxic material". See detailed evaluation below.

Chronic Health Effects : Does not meet criteria. Toxic effects generally not seen at low concentrations (250 ppm or less).

Carcinogenicity : "Very toxic". IARC Group 2A. ACGIH A5.

Teratogenicity and Embryotoxicity : Does not meet criteria. The available information does not suggest that trichloroethylene causes developmental effects. Most studies have either not shown harmful effects in the offspring or have shown effects only in the presence of significant toxicity in the mothers.

Reproductive Toxicity : Insufficient information. It is not possible to conclude that occupational exposure to trichloroethylene causes harmful effects on reproductive function in men or women, based on the limited human information available. Animal studies suggest that exposure to relatively high concentrations of trichloroethylene may produce effects on sperm, including reduced motility, changes in sperm shape and reduced sperm count. However, well-conducted studies have not shown reduced fertility following trichloroethylene exposure.

Mutagenicity : "Toxic". Positive results have been obtained in the somatic cells of animal exposed trichloroethylene with a purity of greater than 99%, using relevant routes of exposure.

Respiratory Tract Sensitization : Does not meet criteria. Not reported as human respiratory sensitizer.

Skin Irritation : "Toxic". Severe skin irritant, based on animal and human evidence.

Eye Irritation : "Toxic". Severe eye irritant, based on limited human information and animal evidence.

Skin Sensitization : Does not meet criteria. No conclusions can be drawn from one case report located.

CLASS E - CORROSIVE MATERIAL : Insufficient information for classification. May attack aluminum, zinc and their alloys when it is unstabilized, uninhibited or lightly inhibited, heated or in the presence of water. No specific information is available on the corrosion rates. Commercial grades which are stabilized, are not corrosive.

CLASS F - DANGEROUSLY REACTIVE MATERIAL : Does not meet criteria.

\*\* US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)  
HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) \*\*

#### OSHA HAZARD COMMUNICATION EVALUATION :

Meets criteria for hazardous material, as defined by 29 CFR 1910.1200.

\*\* EUROPEAN UNION (EU)  
CLASSIFICATION AND LABELLING INFORMATION \*\*

#### EU CLASSIFICATION :

Carcinogenic, Category 2; Mutagenic, Category 3. Vapours may cause drowsiness and dizziness. Irritant. Dangerous for the Environment.  
[Carc.Cat.2;Mut.Cat.3;R67;Xi;R52-53] (47)

#### EU RISK PHRASES :

May cause cancer. Irritating to eyes and skin. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic

environment. Vapours may cause drowsiness and dizziness.  
[R:45-36/38-52/53-67]

EU SAFETY PHRASES :

Avoid exposure - obtain special instruction before use. In case of accident or if you feel unwell, seek medical advice immediately (show label where possible). Avoid release to the environment. Refer to special instructions/safety data sheet. [S:53-45-61]

EU COMMENTS :

Preparations containing this substance have to be assigned R67 (Vapours may cause drowsiness and dizziness) if they meet the EC criteria for volatile substances which cause clear signs of central nervous system depression and which are not already classified with respect to acute inhalation toxicity.

\*\*\* SECTION 16. OTHER INFORMATION \*\*\*

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Information on chemicals reviewed in the CHEMINFO database is drawn from a number of publicly available sources. A list of general references used to compile CHEMINFO records is available in the database Help.

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1998-03-26

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Mutagenicity ; 2003-03-27  
WHMIS health effects; 2003-03-27  
Emergency overview; 2003-03-27  
Handling; 2003-03-27  
Engineering controls; 2003-03-27  
WHMIS classification comments; 2003-05-25  
PEL transitional comments; 2003-12-19  
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Bibliography; 2004-02-09  
Toxicological info; 2004-02-09  
WHMIS detailed classification; 2004-02-09  
Resistance of materials for PPE; 2004-04-06  
Bibliography; 2004-04-06

\*\*\* END OF RECORD \*\*\*

\*\*\* SECTION 1. CHEMICAL IDENTIFICATION \*\*\*

CHEMINFO RECORD NUMBER : 179  
CCOHS CHEMICAL NAME : Benzene  
SYNONYMS :  
\* Benzol  
\* Carbon oil  
\* Coal naphtha  
\* Cyclohexatriene  
\* Phenyl hydride  
CHEMICAL NAME FRENCH : Benzène  
CHEMICAL NAME SPANISH : Benceno  
Benzol  
Ciclohexatrieno  
CAS REGISTRY NUMBER : 71-43-2  
UN/NA NUMBER(S) : 1114  
RTECS NUMBER(S) : CY1400000  
EU EINECS/ELINCS NUMBER : 200-753-7  
CHEMICAL FAMILY : Aromatic hydrocarbon / benzene  
MOLECULAR FORMULA : C6-H6  
STRUCTURAL FORMULA : C6H6 (Benzene ring)

STATUS :

The CHEMINFO record for this chemical is complete. The full format ("TOTAL") provides a detailed evaluation of health, fire and reactivity hazards, as well as recommendations on topics such as handling and storage, personal protective equipment, accidental release and first aid.

\*\*\* SECTION 2. DESCRIPTION \*\*\*

APPEARANCE AND ODOUR :

Clear, colourless liquid with a characteristic, aromatic hydrocarbon odour. (3,30,31)

ODOUR THRESHOLD :

61 ppm (detection); 97 ppm (recognition). Reported values range from 0.78-160 ppm. (31)

WARNING PROPERTIES :

POOR - Odour threshold is above the TLV.

COMPOSITION/PURITY :

Can contain small amounts of toluene and xylene.

USES AND OCCURRENCES :

Benzene is produced from petroleum and coal sources. It is used mainly in the manufacture of ethyl benzene (55%), cumene (24%), cyclohexane (12%), nitrobenzene (5%), detergent alkylate, chlorobenzenes and maleic anhydride. Benzene is a very minor component of gasoline. Its commercial use as a solvent has practically been eliminated because of its toxicity. However, it continues to be used as a solvent and reactant in laboratories. (1,30)

\*\*\* SECTION 3. HAZARDS IDENTIFICATION \*\*\*

\*\* EMERGENCY OVERVIEW \*\*

Clear, colourless liquid with a characteristic, aromatic hydrocarbon odour. EXTREMELY FLAMMABLE LIQUID AND VAPOUR. Can accumulate static charge by flow or agitation. Vapour is heavier than air and may spread long distances. Distant ignition and flashback are possible. Liquid can float on water and may travel to distant locations and/or spread

fire. Can decompose at high temperatures forming toxic gases. Harmful if inhaled or swallowed. Central nervous system depressant. Vapour may cause headache, nausea, dizziness, drowsiness and confusion. May cause blood and bone marrow effects, based on animal data. Causes skin and eye irritation. Aspiration hazard. Swallowing or vomiting of the liquid may result in aspiration into the lungs. CANCER HAZARD - can cause cancer. MUTAGEN - may cause genetic damage.

**\*\* POTENTIAL HEALTH EFFECTS \*\***

**EFFECTS OF SHORT-TERM (ACUTE) EXPOSURE :**

**INHALATION :**

Short-term exposure causes depression of the central nervous system (CNS), marked by drowsiness, dizziness, headache, nausea, loss of coordination, confusion and unconsciousness. No effects are expected at 25 ppm. Exposure to 50 to 150 ppm produces headache, and tiredness.(4) Nose and throat irritation have also been reported following short-term exposure. A period of feeling excited or giddy may precede the onset of other symptoms. Exposure to approximately 20,000 ppm for 5 to 10 minutes may result in death.(1,8)

In general, blood and immune system effects have not been documented in humans following short-term exposures, although these effects have been seen in animals. A 1992 report describes blood system effects in workers exposed to high levels of benzene (estimated to be above 60 ppm) for several days. The workers were also exposed to other chemicals at the same time. In addition to CNS symptoms experienced during the exposure, 9 of the 15 workers had at least 1 blood system abnormality when followed up 4 months later. One year later, 6 workers still had changes in the blood system (numerous large granular lymphocytes).(8)

**SKIN CONTACT :**

Animal evidence has shown that benzene is moderately irritating. Human studies have demonstrated that absorption of liquid benzene or its vapours occurs only to a small extent, but can contribute to overall exposure.(1) There are no reports of skin sensitization.

**EYE CONTACT :**

The vapour can be irritating to the eyes.(8) Animal evidence indicates that splashes of benzene in the eyes will be moderately irritating but will not cause permanent injury.

**INGESTION :**

Benzene is readily absorbed following ingestion producing CNS depression with symptoms as described under inhalation.(1,3) There are no human reports of blood or immune system effects resulting from ingestion, although these effects have been observed in animal experiments.

In one case report, accidental ingestion and/or attempted suicide with benzene produced pneumonitis (probably caused by aspiration of benzene into the lungs) as one of the symptoms.(1) Based on this observation, the physical properties (viscosity and surface tension) and the fact that benzene is a petroleum distillate, benzene can probably be aspirated. Aspiration is the inhalation of a material into the lungs during ingestion or vomiting. Severe lung irritation, damage to the lung tissues and death may result.

**EFFECTS OF LONG-TERM (CHRONIC) EXPOSURE :**

**SKIN :** Prolonged or repeated contact causes redness, dryness, cracking (dermatitis) due to the defatting action of this solvent.(1)

**BLOOD AND BLOOD-FORMING ORGANS:** Although there are limitations to some of the numerous studies, it is conclusive that benzene causes a serious condition where the number of circulating red blood cells (erythrocytes), white blood cells (leukocytes) and clotting cells (thrombocytes) is reduced (pancytopenia). At this stage, effects are thought to be readily reversible. However, continued exposure can result in aplastic anemia or leukemia. Benzene also damages the bone marrow, where new blood cells are produced, resulting in aplastic anemia, which can lead to leukemia.

Typical effects of benzene on the blood system were observed in one study where 217 workers were exposed to 30 to 210 ppm for 3 months to 17

years. (1,4,25) Two studies have shown that low level exposures (less than 1.4 ppm) for long periods of time (up to 21 years) have not resulted in any blood effects. (1,9)

**IMMUNE SYSTEM :** Studies of workers have found changes in the immune system, which are at least partially related to the changes in the blood system discussed above. (1,4)

**NERVOUS SYSTEM:** Two limited studies (there was exposure to other chemicals and exposure levels were not well established) suggest that benzene may cause effects on the peripheral nerves and/or spinal cord. Symptoms included an increased incidence of headaches, fatigue, difficulty sleeping and memory loss among workers with significant exposures. (1)

#### **CARCINOGENICITY :**

The International Agency for Research on Cancer (IARC) has concluded that there is sufficient evidence for carcinogenicity to humans. There are common limitations in the human studies because exposures usually cannot be accurately assessed, the numbers of cases is small and frequently there is exposure to other chemicals. However, there are so many case reports and epidemiologic studies of exposed workers, that a causal relationship between benzene exposure and leukemia has been clearly established. Benzene exposure has also been associated with cancer of the lymph system (lymphoma), lung cancer and bladder (urothelial) cancer. (1,13)

There is one study with low level exposures. The median levels of exposure between 1952 and 1978 were 0.14 ppm for refinery workers and 0.53 ppm for benzene-related units. There were no leukemia deaths in the group and there was no increase in any type of cancer, compared to a similar group or the general population of the United States. (1)

The International Agency for Research on Cancer (IARC) has concluded that this chemical is carcinogenic to humans (Group 1).

The American Conference of Governmental Industrial Hygienists (ACGIH) has designated this chemical as a confirmed human carcinogen (A1).

The US National Toxicology Program (NTP) has listed this chemical as a known human carcinogen.

#### **TERATOGENICITY AND EMBRYOTOXICITY :**

Benzene crosses the placenta but there is no conclusive evidence that it affects the fetus. Most of the studies had limitations such as poor exposure assessment, exposure to other chemicals and a small number of cases.

In a case study of one woman exposed to benzene during two pregnancies (at levels producing severe maternal toxicity), both children were healthy and did not have chromosomal alterations. In another study, 14 children of female workers exposed to benzene and other organic solvents did have chromosomal changes. There was no discussion of maternal toxicity nor birth defects. (1) Animal evidence indicates that benzene is not teratogenic, but is fetotoxic at exposure levels which also resulted in mild maternal toxicity. (1,3,22,23)

#### **REPRODUCTIVE TOXICITY :**

Although there are concerns that historical, high occupational exposures to benzene may be related to menstrual and reproductive problems in women, the available studies have too many limitations to draw any conclusions. (1) Limited animal evidence suggests that benzene may affect reproductive organs at exposure levels which also cause significant toxicity. (2,24)

#### **MUTAGENICITY :**

Despite many limitations, virtually all studies have found positive evidence of mutagenic effects in exposed workers, usually at exposure levels that also produced changes to the blood system. Reports have included chromosomal aberrations in peripheral lymphocytes, clastogenic (DNA) effects as well as damaged chromosomes in hematopoietic (blood-forming) cells. (1) A recent study analyzed chromosome aberrations in workers exposed to levels less than 10 ppm, with occasional peaks of about 100 ppm. There was a slight increase in the incidence of chromosomal aberrations in the exposed group, however this

appeared to be caused by the results of few individuals rather than the group as a whole.(14) In another study, peripheral lymphocytes of a group of 20 female workers exposed to less than 5 ppm benzene (as well as 100 ppm toluene) were examined. There was a significantly increased incidence of DNA damage. In workers who were reexamined 4 months after exposure stopped, the damage had decreased significantly.(15)

#### TOXICOLOGICALLY SYNERGISTIC MATERIALS :

Studies with animals have shown that ethanol increases the blood system changes caused by benzene. Exposure to toluene slows the rate of clearance of benzene by competing for metabolic pathways.(1)

#### POTENTIAL FOR ACCUMULATION :

Benzene is readily absorbed by inhalation or ingestion and is rapidly distributed throughout the body, particularly in fatty tissues. Metabolism occurs primarily in the liver and to a lesser extent in the bone marrow, producing intermediates which account for the toxicity of benzene.(1,13) In humans, the half life is 1 to 2 days. Accumulation is not expected for benzene or its metabolites.(10) Benzene is primarily exhaled through the lungs, unchanged or excreted as metabolites in the urine.(4)

### \*\*\* SECTION 4. FIRST AID MEASURES \*\*\*

#### INHALATION :

This product is flammable. Take proper precautions (e.g. remove any sources of ignition). Take proper precautions to ensure your own safety before attempting rescue; e.g., wear appropriate protective equipment. Remove source of contamination or move victim to fresh air. If breathing has stopped, trained personnel should begin artificial respiration or, if the heart has stopped, cardiopulmonary resuscitation (CPR) immediately. Obtain medical attention immediately.

#### SKIN CONTACT :

Avoid direct contact. Wear chemical protective clothing, if necessary. As quickly as possible, flush with lukewarm, gently flowing water for at least 20 minutes or until chemical is removed. Under running water, remove contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Obtain medical attention immediately. Discard contaminated clothing, shoes and leather goods (e.g. watchbands and belts).

#### EYE CONTACT :

Avoid direct contact. Wear chemical protective gloves, if necessary. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 20 minutes, or until the chemical is removed while holding the eyelid(s) open. Take care not to rinse contaminated water into the non-affected eye. Obtain medical attention immediately.

#### INGESTION :

Never give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim drink 240 to 300 mL (8 to 10 oz.) of water to dilute material in stomach. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Repeat administration of water. Quickly transport victim to an emergency care facility..

#### FIRST AID COMMENTS :

Provide general supportive measures (comfort, warmth, rest). Consult a physician and/or the nearest Poison Control Centre for all exposures except minor instances of inhalation or skin contact. All first aid procedures should be periodically reviewed by a physician familiar with the material and its conditions of use in the workplace.

### \*\*\* SECTION 5. FIRE FIGHTING MEASURES \*\*\*

#### FLASH POINT :

-11 deg C (12 deg F) (closed cup) (28)

#### LOWER FLAMMABLE (EXPLOSIVE) LIMIT (LFL/LEL) :

1.3% (28)

#### UPPER FLAMMABLE (EXPLOSIVE) LIMIT (UFL/UEL) :

7.1% (28)

AUTOIGNITION (IGNITION) TEMPERATURE :

498 deg C (928 deg F) (28)

SENSITIVITY TO MECHANICAL IMPACT :

Insufficient information. Probably not sensitive, since it is a stable material.

SENSITIVITY TO STATIC CHARGE :

Can accumulate static charge by flow or agitation due to the low conductivity of benzene.(29) Vapours in the flammable range may be ignited by a static discharge. Details are not available.

COMBUSTION AND THERMAL DECOMPOSITION PRODUCTS :

Carbon monoxide, carbon dioxide, irritating aldehydes and ketones.

FIRE HAZARD SUMMARY :

Extremely flammable liquid. Vapours can readily ignite at room temperature. Liquid can accumulate static charge by flow or agitation. Vapour can be ignited by a static discharge. Vapour is heavier than air and may travel a considerable distance to a source of ignition and flash back to a leak or open container. Liquid can float on water and may travel to distant locations and/or spread fire. During a fire, irritating/toxic gases may be generated. Benzene can accumulate in confined spaces, resulting in a toxicity and flammability hazard. Containers may explode in heat of fire.

EXTINGUISHING MEDIA :

Carbon dioxide, dry chemical powder, alcohol foam, polymer foam, water spray or fog. Water may be ineffective because it will not cool benzene below its flash point.

FIRE FIGHTING INSTRUCTIONS :

Evacuate area and fight fire from a safe distance or a protected location. Approach fire from upwind to avoid hazardous vapours and toxic decomposition products.

Stop leak before attempting to stop the fire. If the leak cannot be stopped, and if there is no risk to the surrounding area, let the fire burn itself out. If the flames are extinguished without stopping the leak, vapours could form explosive mixtures with air and reignite.

Closed containers may explode in the heat of the fire. Isolate materials not yet involved in the fire and protect personnel. Move containers from fire area if this can be done without risk. Keep cooling streams of water on fire-exposed tanks or containers to minimize the risk of rupture.

Water may be ineffective for fighting fires involving benzene because of its low flash point, unless used under favourable conditions by experienced firefighters trained in fighting all types of flammable liquid fires. However, water can be used on low flash point liquids when applied as a spray to absorb heat and protect exposed material of structures. If a leak or spill has not ignited, use water spray to disperse the vapours and to protect personnel attempting to stop a leak. Solid streams of water may be ineffective and spread material. For a massive fire in a large area, use unmanned hose holder or monitor nozzles. If this is not possible, withdraw from fire area and allow fire to burn. Stay away from ends of tanks. Withdraw immediately in case of rising sound from venting safety device or any discolouration of tank due to fire.

Benzene and its decomposition products are extremely hazardous to health. Do not enter any fire area without specialized protective equipment suitable for the occasion. Firefighter's normal protective equipment (Bunker Gear) will not provide adequate protection. Chemical resistant clothing (e.g. chemical splash suit) and positive pressure self-contained breathing apparatus (MSHA/NIOSH approved or equivalent) may be necessary.

\*\* NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD INDEX \*\*

NFPA - HEALTH

: 2 - Intense or continued (but not chronic)  
exposure could cause  
temporary incapacitation or possible residual

NFPA - FLAMMABILITY : injury.  
: 3 - Liquids and solids can be ignited under almost all normal temperature conditions.

NFPA - REACTIVITY : 0 - Normally stable under fire conditions, and not reactive with water.

\*\*\* SECTION 6. ACCIDENTAL RELEASE MEASURES \*\*\*

SPILL PRECAUTIONS :

Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. Wear adequate personal protective equipment. Ventilate area.  
Extinguish or remove all ignition sources.  
Notify government occupational and environmental authorities.

CLEAN-UP :

Do not touch spilled material. Prevent material from entering sewers or confined spaces.  
Stop or reduce leak if safe to do so.  
Contain spill with earth, sand, or absorbent material which does not react with spilled material.

Small spills: Soak up spill with absorbent material which does not react with spilled chemical. Put material in suitable, covered, labelled containers. Flush area with water.

Contaminated absorbent material may pose the same hazards as the spilled product.

Large spills: Contact fire and emergency services and supplier for advice.

\*\*\* SECTION 7. HANDLING AND STORAGE \*\*\*

HANDLING :

This material is EXTREMELY FLAMMABLE and VERY TOXIC (CANCER HAZARD). Before handling, it is extremely important that engineering controls are operating and that protective equipment requirements and personal hygiene measures are being followed. Whenever possible, closed handling systems for processes involving this material should be used. Only authorized personnel should have access to this material. They should be properly trained regarding its hazards and its safe use. Maintenance and emergency personnel should be advised of potential hazards. If benzene is released, immediately put on a suitable respirator and leave the area until the severity of the release is determined. Immediately report leaks, spills or ventilation failures. Have suitable emergency equipment for fires, spills and leaks readily available. Be aware of typical signs and symptoms of poisoning and first aid procedures. Any signs of illness should be reported immediately to supervisory personnel. Eliminate all ignition sources, (e.g. sparks, open flames, hot surfaces). Keep away from heat. Post "NO SMOKING" signs. It is very important to keep areas where this material is used clear of other materials which can burn. Use non-sparking ventilation systems, approved explosion-proof equipment and intrinsically safe electrical systems in areas of use. Keep aisles and exits free of obstruction. Use in smallest possible amounts in appropriate labelled, containment devices (fume hood, glove box, safety cabinets, isolation cabinets). Containment devices should be made of smooth, unbreakable, compatible material. Maintain containment devices at appropriate air flow and negative pressure. Check regularly. Use benzene in a well ventilated area separate from the storage area. Do not use with incompatible materials such as sodium peroxide, potassium peroxide and many other chemicals (see Incompatibilities: Materials to Avoid). Contact with these materials could lead to vigorous, violent reactions with fire and explosion. Avoid generating vapours or mists. Prevent the release of vapours and mists into the workplace air. To avoid splashing, carefully

dispense into sturdy containers made of compatible materials. Never transfer liquids by pressurizing the original shipping containers with air or inert gas. Attach appropriate warning signs to laboratory entrance, storage area and to containment devices. Use in clearly labelled, designated area(s). Control access to designated area. Access doors must remain closed while this material is present.

Keep a record of acquisition date, opening date and quantity used.

Cover work surfaces with compatible, chemical resistant and/or disposable material for easier containment and clean-up of spills.

Keeping work areas clean is essential. Use work surfaces that can be easily decontaminated. Do not contaminate air or water systems with this material when used in conjunction with vacuum devices. Protect vacuum lines. Use separate vacuum pump inside or vented into appropriate chemical hood. If possible, air flow in laboratory should move from area of lower contamination potential to area of higher contamination potential. Maintain good personal hygiene.

Do not dispense in storage area unless dispensing area is segregated by fire-resistant construction. Only use portable containers and dispensing equipment (faucet, pump, drip can) approved for flammable liquids. Electrically ground all drums, transfer vessels, hoses and piping. Ground clips must contact bare metal. When dispensing in other than a closed system, ensure dispensing container is bonded to receiving transfer equipment and container. Liquid can accumulate charge.

Increase conductivity with additive designed for that purpose, reduce flowrate in transfer operations, increase time the liquid remains in transfer piping and/or handle at lower temperature. Never return contaminated material to its original container. To reduce the fire/explosion hazard, consider the use of an inert gas in the container or storage vessel.

For large scale operations, consider the installation of leak and fire detection equipment along with a suitable, automatic fire suppression system. Label containers. Open containers carefully on a stable surface.

Keep them closed when not in use. Avoid damaging them. Assume that empty containers contain hazardous residues. Never perform any welding, cutting, soldering, drilling or other hot work on an empty vessel, container or piping until all liquid and vapours have been cleared.

Follow handling precautions on Material Safety Data Sheet. Have suitable emergency equipment for fires, spills and leaks readily available. Practice good housekeeping. Maintain handling equipment. Comply with applicable regulations.

#### STORAGE :

Store in a cool, dry, well-ventilated area out of direct sunlight and away from heat and ignition. Keep storage areas clear of burnable materials. Lighted cigarettes, matches or any other ignition sources should not be allowed around indoor or outdoor storage areas. Store away from oxidizers and corrosives and other incompatible materials such as peroxide, potassium peroxide and many other chemicals (see Incompatibility: Materials to Avoid for additional information).

Inspect all incoming containers to make sure they are properly labelled and not damaged. Keep quantity stored as small as possible.

Store in suitable, unbreakable containers made of compatible materials.

Store containers at a convenient height for handling, below eye level if possible. Protect the label and keep it visible. Keep containers tightly closed when not in use and when empty. Protect from damage.

Avoid stacking of containers. Inspect containers regularly for leakage or expired shelf life. Replace defective containers. Have replacement containers and labels on hand.

Store in approved fireproof flammables cabinet or storage room. Store in an isolated fireproof building, if possible. Ground floor storage facilities are usually recommended. Bond and ground metal containers in storage area. Install pressure and vacuum-relief venting in all drums of flammable liquids. Equip storage tank vents with a flame arrestor. Make sure storage area is well ventilated.

Contain spills or leaks by storing in trays made from compatible materials. Keep absorbents for leaks and spills readily available.

Provide raised sills or ramps at doorways or create a trench which

drains to a safe location. Floors should be sealed to prevent absorption. Consider leak detection and alarm equipment for storage area. Avoid bulk storage indoors. Store in isolated fireproof building, if possible. Storage tanks should be sealed on the bottom and placed above ground, surrounded by a dike capable of holding the entire contents.

Store flammable materials according to occupational health and safety regulations and fire and building codes which will describe the kind of storage area and the type of storage containers for a specified amount of the material. Storage facilities should be made of fire-resistant materials. Use a grounded, non-sparking ventilation system, approved explosion-proof equipment and intrinsically safe electrical system. Follow any special instructions for storage on Material Safety Data Sheet (e.g. maximum storage quantities). Store within temperature range recommended by chemical manufacturer/supplier. Alarms that warn of temperatures higher or lower than recommended may be necessary. Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Keep storage area separate from work areas. Store away from work process and production areas, eating areas and protective equipment storage area and also away from elevators, buildings and room exits or main aisles leading to exits. Post warning signs. Inspect periodically for damage, leaks, corrosion and poor housekeeping. Have appropriate fire extinguishers and spill clean-up equipment in or near storage area. Keep empty containers in separate storage area. Assume that empty containers contain hazardous residues. Keep closed.

\*\*\* SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION \*\*\*

NOTE : Exposure to this material can be controlled in many ways. The measures appropriate for a particular worksite depend on how this material is used and on the extent of exposure. This general information can be used to help develop specific control measures. Ensure that control systems are properly designed and maintained. Comply with occupational, environmental, fire, and other applicable regulations.

SAMPLING AND ANALYSIS :

Use appropriate instrumentation and sampling strategy (location, timing, duration, frequency, and number of samples). Interpretation of the sampling results is related to these variables and the analytical method. Sampling should be carried out by trained personnel.

OSHA METHOD No 12. OSHA Analytical Methods Manual 2nd ed. Part 1. Vol. 1. US Department of Labour, January, 1990. Fully validated method. Collection on coconut shell based activated charcoal sorbent tube. Desorption with carbon disulphide (CS<sub>2</sub>). Analysis by gas chromatography using flame ionization detector (FID). Detection limit: 0.04 ppm. Analysis can also be done with a high performance liquid chromatograph using a UV detector (bulk sample).

NIOSH METHOD 3700 - NIOSH Manual of Analytical Methods. 4th ed. Vol. 1. Partially evaluated method. Collection in air bag (Tedlar). Analysis by gas chromatography (portable) using photoionization detector (PID).

NIOSH METHOD 1500 - NIOSH Manual of Analytical Methods. 4th ed. Vol. 2. (Hydrocarbons, BP 36-126 deg C including benzene). Fully evaluated method. Collection on coconut shell based activated charcoal sorbent tube. Desorption with carbon disulphide (CS<sub>2</sub>). Analysis by gas chromatography using flame ionization detector (FID).

NIOSH METHOD 1501 - NIOSH Manual of Analytical Methods. 4th ed. Vol. 2 (Hydrocarbons, aromatic including benzene). Partially evaluated method. Collection on coconut shell based activated charcoal sorbent tube.

Desorption with carbon disulphide (CS<sub>2</sub>). Analysis by gas chromatography using flame ionization detector (FID).

DIRECT READING INSTRUMENTS: Methods of detector in commercially available devices which may be suitable: flame ionization detector, photoionization analyzer, gas chromatograph.

COLORIMETRIC DETECTOR TUBES: Commercially available.

#### ENGINEERING CONTROLS :

Engineering control methods to reduce hazardous exposures are preferred. Methods include mechanical ventilation (dilution and local exhaust), process or personnel enclosure, control of process conditions, and process modification (e.g., substitution of a less hazardous material). Administrative controls and personal protective equipment may also be required.

Because of the high potential hazard associated with this substance, stringent control measures such as enclosure or isolation may be necessary. Use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Exhaust directly to the outside. Supply sufficient replacement air to make up for air removed by exhaust systems.

#### PERSONAL PROTECTIVE EQUIPMENT :

If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protective equipment including approved respiratory protection. Have appropriate equipment available for use in emergencies such as spills or fire.

If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection. Refer to the CSA Standard Z94.4-93, "Selection, Use and Care of Respirators," available from the Canadian Standards Association, Rexdale, Ontario, M9W 1R3.

#### RESPIRATORY PROTECTION GUIDELINES :

NIOSH RECOMMENDATIONS FOR BENZENE CONCENTRATIONS IN AIR (33):

AT CONCENTRATIONS ABOVE THE NIOSH REL, OR WHERE THERE IS NO REL, AT ANY DETECTABLE CONCENTRATION: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

ESCAPE: Gas mask with organic vapour canister; or escape-type SCBA.

NOTE: The NIOSH Recommended Exposure Limit (REL) for Benzene is 0.1 ppm (8-hour time-weighted average concentration) and 1 ppm (15-minute time-weighted average).

NOTE: The IDLH concentration for benzene is 500 ppm. Carcinogenic effects of this compound were not considered in determining the IDLH value.

NOTE: NIOSH has classified this material as a potential occupational carcinogen, according to specific NIOSH criteria. This classification is reflected in these recommendations for respiratory protection, which specify that only the most reliable and protective respirators be worn at any detectable concentration. The requirements in Canadian jurisdictions may vary.

NOTE: The purpose of establishing an IDLH value is to ensure that the worker can escape from a given contaminated environment in the event of the most protective respiratory protection equipment. In the event of failure of respiratory protective equipment every effort should be made to exit immediately.

Recommendations apply only to NIOSH approved respirators. The respirator use limitations specified by the approving agency and the manufacturer must be observed.

ABBREVIATIONS: SAR = supplied-air respirator; SCBA = self-contained breathing apparatus. IDLH = Immediately Dangerous to Life or Health.

EYE/FACE PROTECTION :

Chemical safety goggles. A face shield may also be necessary.

SKIN PROTECTION :

Chemical protective gloves, coveralls, boots, and/or other resistant protective clothing.

Have a safety shower/eye-wash fountain readily available in the immediate work area.

A chemical protective full-body encapsulating suit and respiratory protection may be required in some operations.

Work clothes should be changed at least twice weekly.

RESISTANCE OF MATERIALS FOR PROTECTIVE CLOTHING :

Guidelines for benzene (34):

RECOMMENDED (resistance to breakthrough longer than 8 hours): Polyvinyl alcohol, Barricade(TM), Responder(TM), 4H(TM) (polyethylene/ethylene vinyl alcohol), CPF 3(TM), Tychem 10000(TM).

RECOMMENDED (resistance to breakthrough longer than 4 hours):

Teflon(TM), Viton(TM).

NOT RECOMMENDED for use (resistance to breakthrough less than 1 hour):

Butyl rubber, natural rubber, neoprene, nitrile rubber, polyethylene, polyvinyl chloride, Saranex(TM).

This material is a recognized skin absorption hazard (ACGIH or OSHA).

Recommendations are valid for permeation rates reaching 0.1 ug/cm<sup>2</sup>/min or 1 mg/m<sup>2</sup>/min and over. Resistance of specific materials can vary from product to product. Breakthrough times are obtained under conditions of continuous contact, generally at room temperature. Evaluate resistance under conditions of use and maintain clothing carefully.

PERSONAL HYGIENE :

Remove contaminated clothing promptly. Keep contaminated clothing in closed containers. Discard or launder before rewearing. Inform laundry personnel of contaminant's hazards.

Do not smoke, eat or drink in work areas.

\*\* EXPOSURE GUIDELINES \*\*

\* THRESHOLD LIMIT VALUES (TLVs) / AMERICAN CONFERENCE OF  
GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH) / 2002 \*

TIME-WEIGHTED AVERAGE (TLV-TWA) : 0.5 ppm (1.6 mg/m<sup>3</sup>) Carcinogenicity  
Designation A1 - Skin

SHORT-TERM EXPOSURE LIMIT (TLV-STEL) :

2.5 ppm (8 mg/m<sup>3</sup>)

TLV BASIS - CRITICAL EFFECT(S) : Cancer

TLV COMMENTS :

CARCINOGENICITY DESIGNATION A1 - Confirmed Human Carcinogen: Substance is carcinogenic to humans based on convincing evidence from human studies. For a substance assigned a TLV, exposure should be controlled to levels as low as reasonably achievable below the TLV. Workers exposed to a substance without an assigned TLV should be properly equipped to eliminate virtually all exposure to it.

"SKIN" NOTATION: Contact with skin, eyes, and mucous membranes can contribute to the overall exposure and may invalidate the TLV. Consider measures to prevent absorption by these routes.

BIOLOGICAL EXPOSURE INDICES (BEIs): The ACGIH has adopted a BEI for this chemical. BEIs provide an indication of worker exposure by measuring the chemical or its breakdown products in the body or by measuring biochemical changes resulting from exposure to the chemical. Consult the BEI documentation for further information.

NOTE: In many jurisdictions, exposure limits are similar to the ACGIH TLVs. Since the manner in which exposure limits are established, interpreted, and implemented can vary, obtain detailed information from

the appropriate government agency in each jurisdiction.

\* PERMISSIBLE EXPOSURE LIMITS (PELs) / FINAL RULE LIMITS /  
US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) \*

TIME-WEIGHTED AVERAGE (PEL-TWA) : 1 ppm\*

SHORT-TERM EXPOSURE LIMIT (PEL-STEL) :

5 ppm (15 minute)\*

FINAL RULE LIMIT PEL COMMENTS :

\*TWA ACTION LIMIT: 0.5 ppm

\*NOTE: These limits are taken from OSHA 1910.1028.

\*NOTE: Other limits (cited from OSHA 1910.1000, Table Z-2) apply to industries exempt from the benzene standard or for which the benzene standard is stayed or otherwise not in effect. The limits are:

TIME WEIGHTED AVERAGE: 10 ppm

ACCEPTABLE CEILING CONCENTRATION: 25 ppm

ACCEPTABLE MAXIMUM PEAK ABOVE THE ACCEPTABLE CEILING CONCENTRATION FOR AN 8 HOUR SHIFT: 50 ppm (10 minutes maximum duration).

NOTE: The OSHA PEL Final Rule Limits are currently non-enforceable due to a court decision. The OSHA PEL Transitional Limits are now in force.

\* PERMISSIBLE EXPOSURE LIMITS (PELs) / TRANSITIONAL LIMITS /  
US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) \*

TIME-WEIGHTED AVERAGE (PEL-TWA) : see FINAL RULE LIMITS above

\* EMERGENCY RESPONSE PLANNING GUIDELINES (ERPGs) /  
AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA) / 2002 \*

ERPG-1 : 50 ppm

ERPG-2 : 150 ppm

ERPG-3 : 1000 ppm (36)

The ERPG-1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.

The ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

The ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing life-threatening health effects.

NOTE : Users of the ERPG values are strongly encouraged to consult the documentation before use.

\*\*\* SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES \*\*\*

MOLECULAR WEIGHT : 78.11

CONVERSION FACTOR :

1 ppm = 3.19 mg/m<sup>3</sup>; 1 mg/m<sup>3</sup> = 0.31 ppm at 25 deg C (calculated)

MELTING POINT : 5.5 deg C (42 deg F) (1,3,4)

BOILING POINT : 80 deg C (176 deg F) (28,29)

RELATIVE DENSITY (SPECIFIC GRAVITY) :

0.877 at 20 deg C (water = 1)

SOLUBILITY IN WATER :

Slightly soluble; 180 mg/100 mL of water at 25 deg C (3,29)  
SOLUBILITY IN OTHER LIQUIDS :  
Soluble in all proportions in ethanol, chloroform, diethyl ether, carbon disulfide, acetone, oils, carbon tetrachloride and glacial acetic acid.(3)  
COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT) :  
Lot P(oct) = 1.18-1.9; 2.13; 2.15 (1)  
pH VALUE : Not applicable  
VAPOUR DENSITY : 2.7 (air = 1)  
VAPOUR PRESSURE : 10 kPa (75 mm Hg) at 20 deg C (3,28); 12.7 kPa (95.2 mm Hg) at 25 deg C (1)  
SATURATION VAPOUR CONCENTRATION : 9.9% (98700 ppm) at 20 deg C; 12.5% (approximately 125300 ppm) at 25 deg C (calculated)  
EVAPORATION RATE : 2.8 times slower than diethyl ether = 1 (30)  
CRITICAL TEMPERATURE : 288.9 deg C (552 deg F) (30)  
OTHER PHYSICAL PROPERTIES :  
VISCOSITY-DYNAMIC: 0.647 mPa.s (0.647 centipoises) at 20 deg C (30)  
SURFACE TENSION: 28.9 dynes/cm at 20 deg C (30)  
CRITICAL PRESSURE: 4,925 kPa (48.6 atm) (30)

\*\*\* SECTION 10. STABILITY AND REACTIVITY \*\*\*

STABILITY :  
Normally stable.  
HAZARDOUS POLYMERIZATION :  
Does not occur.  
INCOMPATIBILITY - MATERIALS TO AVOID :  
SODIUM PEROXIDE, POTASSIUM PEROXIDE - spontaneously flammable.(28)  
CHROMIC ANHYDRIDE, PERMANGANIC ACID - can explode on contact.(28,32)  
CHLORINE - can explode.(28)  
NITRIC ACID, OZONE, DIBORANE, INTERHALOGENS (e.g. bromine trifluoride, bromine pentafluoride, chlorine trifluoride, iodine pentafluoride, iodine heptafluoride), DIOXYGEN DIFLUORIDE, DIOXYGENYL TETRAFLUOROBORATE, PERMANGANIC ACID, PEROXODISULFURIC ACID, PEROXOMONOSULFURIC ACID - may react violently or explosively with risk of fire.(28,30,32)  
METAL PERCHLORATES (e.g. silver perchlorate) - if recrystallized from benzene, can explode spontaneously.(28)  
NITRYL PERCHLORATE - reaction with benzene can give a slight explosion and flash.(28,32)  
URANIUM HEXAFLUORIDE - reacts vigorously.(32)  
HAZARDOUS DECOMPOSITION PRODUCTS :  
None known.  
CONDITIONS TO AVOID :  
Static charge, sparks, open flames, heat and other ignition sources.  
CORROSIVITY TO METALS :  
Not corrosive to metals.  
STABILITY AND REACTIVITY COMMENTS :  
Attacks rubber and plastics.(29)

\*\*\* SECTION 11. TOXICOLOGICAL INFORMATION \*\*\*

LC50 (rat): 13,700 ppm (4 hour exposure) (26); 9,980 ppm (7 hour exposure) (13,200 ppm - equivalent 4 hour exposure) (18)  
LD50 (oral, rat): 930 mg/kg (19); 5,600 mg/kg (2); 11.4 mL/kg (10,032 mg/kg) (21)  
LD50 (oral, mouse): 4,700 mg/kg (11; unconfirmed)  
LD50 (skin, rabbit and guinea pig): Greater than 9,400 mg/kg (20)

EYE IRRITATION (rabbit): Application of 2 drops produced moderate irritation with very slight, temporary injury to the cornea.(2)  
Application of 0.1 mL (88 mg) in a Standard Draize test produced moderate eye irritation.(21)

SKIN IRRITATION (rabbit): In a Standard Draize test, slight to moderate

irritation and moderate tissue death (necrosis) was produced.(2) In an Open Draize test, 0.01 ml (8.8 mg) produced mild skin irritation.(21)

SKIN SENSITIZATION (guinea pig): One report of skin sensitization cannot be confirmed.(4)

EFFECTS OF SHORT-TERM (ACUTE) EXPOSURE: The immediately noticeable effect is depression of the central nervous system (CNS) with drowsiness, incoordination and unconsciousness, eventually leading to death.(1) On autopsy, slight liver, and sometimes kidney, changes were noted.(2)

In many studies, short-term exposure to very low levels by inhalation or ingestion has caused very harmful changes to the blood and immune systems. All major types of blood cells, including red blood cells, platelets and white blood cells are susceptible. Two common effects are a decreased number of lymphocytes (cells which produce antibodies) (lymphocytopenia) and a reduced number of red blood cells (anemia). Mice exposed continuously by inhalation to 21 ppm for 4 to 10 days, showed significant changes in all blood parameters tested. Concentrations as low as 10 ppm have caused immunological changes in rats. Some effects may be reversible once exposure stops.(1,13) A few studies have been reported regarding potential behavioural effects of benzene. Increased behavioural activity (sleeping, grooming, locomotion and fighting) was observed in mice following exposure to 300 or 900 ppm for 5 days.(1) The significance of these changes is not known.

EFFECTS OF LONG-TERM (CHRONIC) EXPOSURE:

EFFECTS ON THE BLOOD AND BLOOD-FORMING ORGANS: Extensive studies have conclusively proven that oral and inhalation exposure to benzene causes severe effects on the blood system, including damaging the bone marrow where new blood cells are formed. Most studies report a decrease in hemoglobin, hematocrit, red and white blood cells, platelets and/or changes in the cells. Effects of varying severity have been demonstrated with both intermittent and continuous exposures to concentrations as low as 10 ppm for 24 weeks.(1,3)

EFFECTS ON THE IMMUNE SYSTEM: Studies have also conclusively shown that benzene causes harmful changes to the immune system which protects the body from disease. Benzene has decreased the number of mature B- and T-lymphocytes (white blood cells which produce disease-fighting antibodies). Exposure of mice to 300 ppm for 6 to 23 weeks resulted in a decrease in the number of mature B- and T-lymphocytes. Rats and mice exposed orally to 25 to 200 mg/kg/day for 2 years had significantly reduced white blood cells and lymphocytes.(1)

CARCINOGENICITY: The International Agency for Research on Cancer (IARC) has concluded that there is sufficient evidence for the carcinogenicity of benzene in animals. Benzene is known to be carcinogenic in humans.(12) Inhalation and ingestion studies with rats and mice have shown cancer of the lymph system (lymphoma), the blood (leukemia), and the bone marrow (myeloma), as well as tumours of the liver, zymbal gland, mammary gland, lungs, thymus, nasal and oral cavities. Inhalation exposures were in the range of 100 to 1,200 ppm while ingestion exposures were 25 to 500 mg/kg, usually for the lifetime of the animal.(1,12,13)

TERATOGENICITY/EMBRYOTOXICITY: Many studies have been conducted on rats, mice and rabbits, primarily with inhalation exposures and with concentrations ranging up to 2,200 ppm. Results show that benzene is not teratogenic or embryotoxic even at levels that caused maternal toxicity. Fetal toxicity (reduced birth weight and/or minor skeletal variations) was observed at exposures above 50 ppm. In these studies, mild maternal toxicity was also seen (reduced weight gain).(1,3,22,23)

REPRODUCTIVE TOXICITY: Benzene does not appear to cause reproductive toxicity. Effects on reproductive organs (testes and ovaries) have been

shown at doses which caused other significant signs of toxicity in the animals.(2,24)

Female rats were exposed to up to 300 ppm, 6 hours per day, from 10 weeks pre-mating through nursing of the offspring with no effect on female reproductive performance.(5) In another study, where female rats were exposed continuously to 210 ppm 10 to 15 days before and 3 weeks after mating, there were no litters. There are no further details available for interpretation of this study.(1)

MUTAGENICITY: Benzene has been extensively examined in mutagenicity studies with rats and mice with positive results in virtually all tests reported. Analyses of bone marrow and lymphocytes of animals exposed to concentrations as low as 1 ppm have found increases in chromosomal aberrations, sister chromatid exchanges and micronuclei. Other studies have shown changes in DNA in certain cell types.(1) Recent studies have focused on mutagenesis with low-level short-term exposures. Prolonged exposure of mice to levels at or below 1 ppm (40, 100 and 1000 ppb for 22 hours per day for 6 weeks), produced an increase in mutations in lymphocytes at the two lower exposure levels.(6,7)

### \*\*\* SECTION 12. ECOLOGICAL INFORMATION \*\*\*

NOTE : Inclusion of Ecological Information on an MSDS is optional under the US Hazard Communication Standard and the Canadian Controlled Products Regulations (WHMIS). In other jurisdictions, inclusion of Ecological Information may be a requirement. For specific requirements, contact the relevant regulatory authorities in the jurisdiction where the MSDS is intended to be used.

The American National Standard for Hazardous Industrial Chemicals - Material Safety Data Sheets - Preparation (ANSI 2400.1-1998) provides advice on data that could be included in this section, as well as ecotoxicological tests and issues.

Databases in CCOHS's CD-ROM and Web collection which contain useful Ecological Information include CESARS, HSDB(R) (Hazardous Substances Data Bank) and CHRIS (Chemical Hazards Response Information System).

### \*\*\* SECTION 13. DISPOSAL CONSIDERATIONS \*\*\*

Review federal, provincial and local government requirements prior to disposal.

Disposal by controlled incineration may be acceptable.

### \*\*\* SECTION 14. TRANSPORT INFORMATION \*\*\*

#### \*\* CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG) SHIPPING INFORMATION \*\*

SHIPPING NAME AND DESCRIPTION: BENZENE

UN NUMBER: UN1114

CLASS: 3

PACKING GROUP/RISK GROUP: II

SPECIAL PROVISIONS: ---

PASSENGER CARRYING ROAD/RAIL LIMIT: 5 kg or L

MARINE POLLUTANT: ---

NOTE: This information incorporates the Transportation of Dangerous Goods Regulations SOR/2001-286, effective August 1, 2002.

#### \*\* US DEPARTMENT OF TRANSPORT (DOT) HAZARDOUS MATERIALS SHIPPING INFORMATION (49 CFR) \*\*

HAZARDOUS MATERIAL DESCRIPTION AND PROPER SHIPPING NAME: BENZENE

HAZARD CLASS OR DIVISION: 3

IDENTIFICATION NUMBER: UN1114  
PACKING GROUP: II

NOTE : This information was taken from the US Code of Federal Regulations Title 49 - Transportation and is effective October 2002.

\*\*\* SECTION 15. REGULATORY INFORMATION \*\*\*

\*\* CANADIAN WORKPLACE HAZARDOUS MATERIALS  
INFORMATION SYSTEM (WHMIS) \*\*

PROPOSED WHMIS CLASSIFICATION :

B2 - Flammable and combustible material - Flammable liquid  
D2A - Poisonous and infectious material - Other effects - Very toxic  
D2B - Poisonous and infectious material - Other effects - Toxic

WHMIS HEALTH EFFECTS :

Chronic toxicity - toxic - other  
Carcinogenicity - very toxic - other  
Skin irritation - toxic - other  
Eye irritation - toxic - other  
Mutagenicity - toxic - other

WHMIS INGREDIENT DISCLOSURE LIST :

Meets criteria for disclosure at 0.1% or greater.

DETAILED WHMIS CLASSIFICATION ACCORDING TO CRITERIA :

CLASS A - COMPRESSED GAS: Does not meet criteria  
CLASS B - FLAMMABLE & COMBUSTIBLE MATERIAL: Classified as "flammable liquid"; flash point -11 deg C (12 deg F) (closed cup) (28)  
CLASS C - OXIDIZING MATERIAL: Does not meet criteria  
CLASS D - POISONOUS AND INFECTIOUS MATERIAL. DIVISION 1 - IMMEDIATE AND SERIOUS TOXIC EFFECTS: Does not meet criteria  
Acute Lethality: Does not meet criteria. LC50 (rat): 13700 ppm (4-hour exposure) (26); LD50 (oral, rat): 930 to 10032 mg/kg (2,19,21); LD50 (dermal, rabbit and guinea pig): Greater than 9400 mg/kg.(20)  
CLASS D - POISONOUS AND INFECTIOUS MATERIAL. DIVISION 2 - OTHER TOXIC EFFECTS: Meets criteria for both "Very toxic" and "Toxic" material.  
See detailed evaluation below.  
Chronic Health Effects: "Toxic". Exposure of workers to 30 to 210 ppm for 3 months to 17 years resulted in the development of blood effects.(1,4)  
Carcinogenicity: "Very Toxic"; ACGIH A1 carcinogen and IARC Group 1 carcinogen.  
Teratogenicity and Embryotoxicity: There is no conclusive evidence in human studies. Animal evidence indicates that benzene is not teratogenic, but is fetotoxic at exposure levels which resulted in mild maternal toxicity.  
Reproductive Toxicity: Probably does not meet criteria. There is no conclusive evidence in human studies.(1) Limited animal evidence suggests that benzene may affect reproductive organs at exposure levels which cause significant animal toxicity.  
Mutagenicity: "Toxic". Positive evidence of mutagenic effects in exposed workers.(1)  
Respiratory Sensitization: Does not meet criteria; not reported as human respiratory sensitizer.  
Skin Sensitization: Insufficient information  
Skin Irritation: "Toxic"; moderate skin irritation in a standard Draize test in rabbits.(2)  
Eye Irritation: "Toxic"; moderate to severe irritation in a standard Draize test in rabbits.(21)  
CLASS E - CORROSIVE MATERIAL: Does not meet criteria  
CLASS F - DANGEROUSLY REACTIVE MATERIAL: Does not meet criteria

\*\* US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)  
HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) \*\*

OSHA HAZARD COMMUNICATION EVALUATION :

Meets criteria for hazardous material, as defined by 29 CFR 1910.1200.

\*\* EUROPEAN UNION (EU)

CLASSIFICATION AND LABELLING INFORMATION \*\*

EU CLASSIFICATION :

Highly flammable. Carcinogenic, category 1. Toxic.  
[F;carc.cat.1;T].(35)

EU RISK PHRASES :

May cause cancer. Highly flammable. Also toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. [R:45-11-48/23/24/25].

EU SAFETY PHRASES :

Avoid exposure - obtain special instruction before use. In case of accident or if you feel unwell, seek medical advice immediately (show label where possible). [S:53-45].

\*\*\* SECTION 16. OTHER INFORMATION \*\*\*

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Information on chemicals reviewed in the CHEMINFO database is drawn from a number of publicly available sources. A list of general references used to compile CHEMINFO records is available in the database Help.

REVIEW/PREPARATION DATE :

1995-02-28

REVISION INDICATORS :

EXPOSURE CONTROLS; 1995-09-01

Sampling; 1995-11-01

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Respiratory guidelines; 1995-11-01  
EU number; 1995-11-01  
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ERPG; 1996-09-01  
TLV-TWA; 1997-09-01  
TLV-STEL; 1997-09-01  
US transport; 1998-03-01  
Resistance of materials; 1998-06-01  
TLV comments; 1998-08-01  
WHMIS (proposed class); 2000-06-01  
WHMIS (detailed class); 2000-06-01  
TDG; 2002-05-27  
Carcinogenicity; 2002-12-17  
Bibliography; 2002-12-17

\*\*\* END OF RECORD \*\*\*

\* \* \* \* \*  
\* C H E M I N F O \*  
\*  
\* Canadian Centre for Occupational Health and Safety \*  
\* \* \* \* \* Issue : 2002-3 (August, 2002) \*

\*\*\* SECTION 1. CHEMICAL IDENTIFICATION \*\*\*

CHEMINFO RECORD NUMBER : 206  
CCOHS CHEMICAL NAME : Vinyl chloride  
SYNONYMS :  
\* Chlorethene  
\* Chloroethene  
\* Chloroethylene  
\* 1-Chloroethylene  
\* Ethylene monochloride  
\* Monochloroethene  
\* Monochloroethylene  
\* VC  
\* VCM  
\* Vinyl chloride monomer  
\* Vinyl C monomer  
\* Chlorure de vinyle  
CAS REGISTRY NUMBER : 75-01-4  
UN/NA NUMBER(S) : 1086  
RTECS NUMBER(S) : KU9625000  
EU EINECS/ELINCS NUMBER : 200-831-0  
CHEMICAL FAMILY : Halogenated aliphatic hydrocarbon /  
unsaturated halogenated aliphatic  
hydrocarbon / haloalkene / monohaloalkene  
monochloroalkene /  
halogenated ethylene / monochloroethylene .  
vinyl halide / vinyl chloride  
MOLECULAR FORMULA : C<sub>2</sub>H<sub>3</sub>Cl  
STRUCTURAL FORMULA : CH<sub>2</sub>=CH-Cl

STATUS :

The CHEMINFO record for this chemical is complete. The full format ("TOTAL") provides a detailed evaluation of health, fire and reactivity hazards, as well as recommendations on topics such as handling and storage, personal protective equipment, accidental release and first aid.

\*\*\* SECTION 2. DESCRIPTION \*\*\*

APPEARANCE AND ODOUR :

Colourless gas with a pleasant, sweet, ethereal odour; colourless liquid below -14 deg C (7 deg F) (22,23)

ODOUR THRESHOLD :

Reported values vary widely; 10-20 ppm (method not given) (24); 2000 ppm (method not given) (8); 3000 ppm (method not given) (4)

WARNING PROPERTIES :

POOR - reported values vary widely and are above the TLV

COMPOSITION/PURITY :

Vinyl chloride is available in various grades and typically has a minimum purity of 99.9 mole percent in the liquid phase. It is shipped as a liquefied compressed gas under its own vapour pressure of 234 kPa at 21.1 deg C (70 deg F). (13,22,25) It may contain small amounts of acetylene, acetaldehyde, 1,3-butadiene, 1- and 2-butene, ethylene, ethylene dichloride, propylene, vinyl acetylene, methyl chloride, hydrogen chloride or water as impurities. (26,27) It is normally stabilized (inhibited) with phenol (40-100 ppm) to prevent polymerization. (22,23,27)

USES AND OCCURRENCES :

It is used mainly for the manufacture of polyvinyl chloride (PVC) plastics and resins. and vinyl chloride copolymers. It is used as a

chemicals; and in the production of adhesives.(22,27,28)

### \*\*\* SECTION 3. HAZARDS IDENTIFICATION \*\*\*

#### \*\* EMERGENCY OVERVIEW \*\*

Colourless gas with a pleasant, sweet, ethereal odour; colourless liquid below -14 deg C (7 deg F). EXTREMELY FLAMMABLE GAS. Gas is heavier and colder than air and may spread long distances. Distant ignition and flashback are possible. Can decompose at high temperatures forming toxic gases such as hydrogen chloride, phosgene and acetylene. COMPRESSED GAS. Confined space hazard. DANGEROUSLY REACTIVE. Gas or uninhibited liquid may polymerize explosively when exposed to air, sunlight (ultraviolet light), elevated temperatures, and the presence of incompatible materials, such as peroxides and other oxidizing materials. May form explosive peroxides in the presence of air or oxygen. Mild central nervous system depressant. Very high concentrations may cause headache, nausea, dizziness, drowsiness, incoordination and confusion. May cause frostbite. CANCER HAZARD - can cause cancer, based on human information. MUTAGEN - may cause genetic damage.

#### \*\* POTENTIAL HEALTH EFFECTS \*\*

##### EFFECTS OF SHORT-TERM (ACUTE) EXPOSURE :

###### INHALATION :

Irritation and odour do not provide adequate warning of exposure to low concentrations of vinyl chloride. Current occupational exposure limits are 1-5 ppm. Very high concentrations (greater than 8000 ppm) cause depression of the central nervous system (CNS). The most commonly observed CNS effects are weakness, dizziness, nausea, fatigue, headache, incoordination and loss of consciousness. Severe exposures can result in death. Studies with volunteers show that the earliest effects (dizziness) begin to appear at 8000 ppm.(1) Significantly higher concentrations (16000 to 25000 ppm) have resulted in dizziness, lightheadedness, headaches and disorientation.(1,2) Even higher exposures would produce unconsciousness and death. Two deaths have been reported from short-term exposure to vinyl chloride in confined spaces.(3) Relatively high vinyl chloride concentrations (a few hundred ppm and higher) are associated with significant long-term health effects. Refer to "Effects of Long-Term (Chronic) Exposure" below for additional information.

###### SKIN CONTACT :

Frostbite can occur due to the extremely rapid evaporation of the liquid.(4) Symptoms of mild frostbite include numbness, prickling and itching in the affected area. Symptoms of more severe frostbite include a burning sensation and stiffness of the affected area. The skin may become waxy white or yellow. Blistering, tissue death and gangrene may also develop in severe cases.

There is one case report of a worker who had the liquefied gas sprayed on his hands. Initially his hands felt numb, but within a short period of time there was marked redness and swelling which developed into second degree burns.(4)

###### EYE CONTACT :

Frostbite can occur due to the extremely rapid evaporation of the liquid. Permanent eye damage or blindness could result. In one fatal inhalation case, there were local burns to the eye from the liquefied gas sprayed out of an open valve.(4) Eye irritation has not been observed in animals exposed to very high gas concentrations.

###### INGESTION :

Ingestion is not an applicable route of exposure for gases.

##### EFFECTS OF LONG-TERM (CHRONIC) EXPOSURE :

Numerous human population studies and case reports have led to the identification of significant long-term health effects, which are sometimes collectively referred to as "Vinyl chloride disease". Most of these effects resulted from inhalation exposures which occurred before major reductions in workplace exposures during the 1970's. While it is difficult to accurately estimate actual exposures during this time.

skeletal, immune system, skin, respiratory, blood and nervous system effects have all been associated with long-term, higher level vinyl chloride exposure.

**LIVER/SPLEEN EFFECTS :** Severe and characteristic liver damage and liver abnormalities have been reported in a large number of studies. The incidence and severity of the liver effects increases with the concentration and duration of exposure. Animal studies indicate that significant liver changes can be seen at concentrations as low as 50 ppm with a 6 month exposure. Human liver effects may not be recognized early because the changes are not necessarily reflected in standard liver function tests. Enlargement of the spleen (splenomegaly) has also been reported in some studies.(4-8)

**VASCULAR EFFECTS (RAYNAUD'S PHENOMENON/SYNDROME):** Raynaud's Phenomenon is a condition where the fingers become white and numb following exposure to cold. These symptoms occur because the walls of arteries in the fingers become thick, resulting in impaired blood circulation. Raynaud's phenomenon has most commonly been seen in workers repeatedly and heavily exposed to vinyl chloride while cleaning reactor tanks. Although only a small percentage of vinyl chloride workers have developed Raynaud's Phenomenon, the incidence is higher than in unexposed workers. Some reports indicate that Raynaud's Phenomenon gradually disappears upon removal from exposure.(4-8)

**SKELETAL EFFECTS (ACROOSTEOLYSIS) :** Acroosteolysis is a condition which results in the destruction and absorption of the tips of the bones of the end of the fingers. In some cases, other bones (for example, the toes, the sacroiliac joint and the kneecap) are also involved. Acroosteolysis has been observed in a small percentage of vinyl chloride workers in several studies. Like Raynaud's Phenomenon, acroosteolysis has been observed primarily in workers heavily exposed to vinyl chloride. Acroosteolysis has appeared in workers between 5 and 42 months after first exposure. Workers with acroosteolysis have generally showed symptoms of Raynaud's Phenomenon first. It is not clear if this condition is reversible when exposure stops. Two studies showed improvement and two showed progression of the disease.(4-8)

**SKIN EFFECTS (SCLERODERMA) :** Skin effects have been observed in a small percentage of vinyl chloride workers in several studies. The skin becomes thick and has a whitish, scaly appearance, possibly due to collagen deposits. These effects are by far most often observed on the skin of the hands and wrists. Skin effects have almost exclusively been observed in the same workers who have Raynaud's Phenomenon and/or acroosteolysis.(4,5,7,8)

**IMMUNE SYSTEM EFFECTS:** A small number of studies have shown immune system effects in vinyl chloride workers, generally with higher exposures. The most common findings are increased circulating immune complexes and the presence of an abnormal protein in the blood (cryoglobulinemia). The severity of Raynaud's Phenomenon, acroosteolysis and skin effects has been associated with the extent of immune system abnormalities in some studies, but not others. Therefore, it is thought that these disorders may have an immune basis.(4,6,8)

**RESPIRATORY EFFECTS:** The available information gives conflicting results. Several studies found no increase in respiratory disease while other studies and case reports have found effects, such as an increased incidence of emphysema, pulmonary fibrosis and abnormal X-ray results. No conclusions can be drawn as there are limitations to these studies, such as exposure to other chemicals and the inclusion of smokers.(4,6,8) A recent study of a large group found a statistically significant increase in deaths due to emphysema.(9)

**NERVOUS SYSTEM EFFECTS:** Signs of damage to the nervous system in the extremities (the hands, arms, legs and feet) have been observed some studies of vinyl chloride workers. The condition is referred to as

in 70% of a group of exposed workers. Other studies have involved workers who also had Raynaud's Phenomenon and/or acroosteolysis. It is possible that some of the reported symptoms may be related to these disorders rather than peripheral neuropathy and the disorders are most probably inter-related.(4)

**BLOOD EFFECTS :** Most studies have reported a mild to severe increase in the number of blood platelets (thrombocytopenia). Some other studies have shown increased levels of plasma proteins.(4,6) In a study of female workers exposed to 0.2 to 130.7 ppm vinyl chloride, a reduced platelet count was observed in the early part of pregnancy. This effect was not seen by the end of pregnancy, following a period of no exposure.(4)

**GASTROINTESTINAL EFFECTS:** No conclusions can be drawn from the limited information available. In one study, a very small number of workers with pre-existing liver dysfunction also reported symptoms such as nausea, abdominal distention and heartburn.(10) Another study reported that 99/354 workers had a history of gastritis and ulcers. Some of these workers also had liver and/or spleen enlargement.(11) The results were not compared to a control group.

#### **CARCINOGENICITY :**

Approximately 30 years after the use of vinyl chloride in industrial production of polyvinyl chloride (PVC) began, there were reports of a high occurrence of a relatively rare cancer, liver angiosarcoma, in vinyl chloride workers. Virtually all relevant human population studies have confirmed this finding. The highest incidence of liver angiosarcoma has been observed in workers with the highest exposure and the longest duration of exposure. Human population studies have also associated vinyl chloride exposure with other forms of liver cancer, cancer of the lung, lymph and blood forming system, and the brain and central nervous system.(4,8,12) The International Agency for Research on Cancer (IARC) has concluded that there is sufficient evidence for the carcinogenicity of vinyl chloride in humans (Group 1).(12) The US National Toxicology Program (NTP) identifies vinyl chloride as a known carcinogen.(13) Vinyl chloride is regulated by the US Occupational Safety and Health Administration (OSHA) as a carcinogen and is classified by the ACGIH as a confirmed human carcinogen (A1).

IARC coordinated a large study to investigate the dose-response relationship between liver cancer and exposure to vinyl chloride and to assess the cancer risk for other sites. Results from this large study (12706 subjects) with exposure of at least one year showed an excess of liver cancer including angiosarcoma which was clearly related to time since first exposure, duration of employment and estimated exposure. Other cancer sites investigated were either not higher than expected or were unrelated to vinyl chloride exposure.(14) Another comprehensive industry-wide study of 10173 men who had at least one year of occupational exposure to vinyl chloride also confirmed a significant excess mortality from liver cancer, including angiosarcoma and biliary tract cancer. This study also confirmed an excess of central nervous system and brain cancer.(9)

#### **TERATOGENICITY AND EMBRYOTOXICITY :**

A number of human population studies have investigated the possibility of effects on the unborn child in communities with vinyl chloride industries and in people occupationally exposed to vinyl chloride. Many of these studies were poorly conducted. Nevertheless, a statistically significant relationship between developmental effects in children and parental occupation or physical proximity to vinyl chloride industries has not been demonstrated. One study reported no significant developmental effects (fetotoxicity, embryotoxicity or teratogenicity) in the children of mothers who were occupationally exposed to 0.2 to 130.7 ppm vinyl chloride for more than 1 year.(4,15) Animal information is weak but suggests that teratogenic, embryotoxic and fetotoxic effects would not be observed in the absence of maternal toxicity.

#### **REPRODUCTIVE TOXICITY :**

An extensive review has concluded that information relating vinyl chloride exposure in the father and possible reproductive effects, such as increased miscarriages in the mother, is sparse, conflicting and

Other possible reproductive effects have included impotence and decreased sexual function in both men and women. No conclusions can be drawn from these studies because of factors such as concurrent exposure to other potentially harmful chemicals and the results were not related to exposure levels or subjected to statistical analysis.(4,15) Animal studies suggest that high concentrations of vinyl chloride may have testicular effects, but no conclusions can be drawn regarding effects on fertility.

#### MUTAGENICITY :

There have been numerous studies of the mutagenic effects of vinyl chloride in people with occupational exposure, especially chromosomal aberrations.(4,5,8,12,16,18) A clear correlation between the incidence of chromosomal aberrations and the duration or level of exposure has been observed.(18) Positive results have also been obtained in live animals and in cultured mammalian cells and bacteria.

#### TOXICOLOGICALLY SYNERGISTIC MATERIALS :

In studies with rats, ethanol increased the incidence of liver angiosarcoma causing an earlier onset of tumours and an increased death rate.(4,6,12)

#### POTENTIAL FOR ACCUMULATION :

Vinyl chloride is rapidly absorbed following inhalation. Significant absorption through the skin does not occur. Once absorbed into the body, the liver converts vinyl chloride to several other chemicals (metabolites). Some metabolites are excreted mainly in the urine, largely within 1 day of absorption. Very little is exhaled as carbon dioxide or eliminated in the feces. Other metabolites, a few of which are more toxic than vinyl chloride, stay in the body longer and are responsible for some of the harmful effects of vinyl chloride, particularly in the liver. Eventually these chemicals are also excreted from the body. Only small amounts of unchanged vinyl chloride are exhaled at low exposure concentrations. If the amount of vinyl chloride exceeds the capacity of the liver, exhalation of unchanged vinyl chloride becomes the major route of excretion.(4)

### \*\*\* SECTION 4. FIRST AID MEASURES \*\*\*

#### INHALATION :

This chemical is extremely flammable. Take proper precautions (e.g. remove any sources of ignition). Take proper precautions to ensure your own safety before attempting rescue; e.g. wear appropriate protective equipment. Remove source of contamination or have victim move to fresh air. Obtain medical attention immediately.

#### SKIN CONTACT :

Quickly remove victim from source of contamination and briefly flush with lukewarm, gently flowing water until the chemical is removed. DO NOT attempt to rewarm the affected area on site. DO NOT rub area or apply dry heat. Gently remove clothing or jewelry that may restrict circulation. Carefully cut around clothing that sticks to the skin and remove the rest of the garment. Loosely cover the affected area with a sterile dressing. DO NOT allow victim to drink alcohol or smoke. Quickly transport victim to an emergency care facility.

#### EYE CONTACT :

Quickly remove victim from source of contamination. Immediately and briefly flush with lukewarm, gently flowing water until the chemical is removed. DO NOT attempt to rewarm. Cover both eyes with a sterile dressing. DO NOT allow victim to drink alcohol or smoke. Quickly transport victim to an emergency care facility.

#### INGESTION :

Ingestion is not an applicable route of exposure for gases.

#### FIRST AID COMMENTS :

Provide general supportive measures (comfort, warmth, rest). Consult a doctor and/or the nearest Poison Control Centre for all exposures. All first aid procedures should be periodically reviewed by a doctor familiar with the material and its conditions of use in the workplace.

### \*\*\* SECTION 5. FIRE FIGHTING MEASURES \*\*\*

open cup flash point of -77.8 deg C (-108 deg F) has been reported.(26,29)  
LOWER FLAMMABLE (EXPLOSIVE) LIMIT (LFL/LEL) :

3.6-4.0% (23,26,29)

UPPER FLAMMABLE (EXPLOSIVE) LIMIT (UFL/UEL) :

20% (26,28); 33% (4,23,29)

AUTOIGNITION (IGNITION) TEMPERATURE :

472 deg C (882 deg F) (23,26,29)

SENSITIVITY TO MECHANICAL IMPACT :

Stable material. Probably not sensitive.

SENSITIVITY TO STATIC CHARGE :

No information is available on the electrical conductivity of vinyl chloride. Vinyl chloride gas in the flammable range may be ignited by a static discharge of sufficient energy. Minimum ignition energy: less than 0.3 millijoules.(30) Discharge of a spray of gas and liquid under pressure from a cylinder generated static charge and ignited the gas.(31)

COMBUSTION AND THERMAL DECOMPOSITION PRODUCTS :

Above 450 deg C, partial decomposition occurs yielding acetylene and hydrogen chloride, with possible trace amounts of chloroprene.

Combustion in air at 510-795 deg C produces carbon monoxide, carbon dioxide and hydrogen chloride. Traces of phosgene are formed under oxygen deficient combustion.(26,28)

FIRE HAZARD SUMMARY :

Extremely flammable gas. Can readily form explosive mixtures with air over a very wide range. Low ignition energy. Hazardous polymerization may occur under fire conditions. Fire-exposed containers may rupture violently due to polymerization. Vinyl chloride gas is uninhibited and may polymerize explosively in a fire and may form polymers in vents and flame arresters, resulting in blockage of vents. Gas is heavier and colder than air and may hug the ground and can travel a considerable distance to a source of ignition and flash back to a leak. During a fire, toxic/corrosive hydrogen chloride and phosgene gases may be generated. Can accumulate in confined spaces, resulting in an toxicity, flammability and explosion hazard.

EXTINGUISHING MEDIA :

Carbon dioxide or dry chemical powder.(23,29) Water will not be effective because it cannot cool vinyl chloride below its flash point.

FIRE FIGHTING INSTRUCTIONS :

Evacuate area and fight fire from a safe distance or protected location. Approach fire from upwind to avoid hazardous gas and toxic decomposition products.

For fires involving flammable gases, the best procedure is to stop the flow of gas before attempting to extinguish the fire. To extinguish the fire, while allowing continued flow of the gas, is extremely dangerous. The gas could form an explosive mixture with air and reignite, which may cause far more damage than if the original fire had been allowed to burn. In some cases, extinguishing the fire with carbon dioxide or dry chemical powder may be necessary to permit immediate access to valves to shut off the flow of gas. However, this must be done carefully. If it is not possible to stop the flow of gas and if there is no risk to the surrounding area, it is preferable to allow continued burning, while protecting exposed materials with water spray until the flow of gas can be stopped. Gas clouds may be controlled by water spray or fog. Note that addition of water to any pools of liquefied vinyl chloride may increase evolution of gas. Isolate materials not yet involved in the fire and protect personnel.

Move cylinders from fire area if this can be done without risk.

Otherwise, fire-exposed containers, tanks or pipelines should be cooled by application of hose streams and this should begin as soon as possible (within the first several minutes) and should concentrate on any unwetted portions of the container. No part of a cylinder should be subjected to a temperature higher than 52 deg C (approximately 125 deg F). Otherwise, the heat generated by the fire will cause their contents to polymerize. If this is not possible, use unmanned monitor nozzles and immediately evacuate the area. For a massive fire in a large area, use unmanned hose holder or monitor nozzles; if this is not possible withdraw from fire area and allow fire to burn. Stay away from ends of tanks. but be aware that flying material from ruptured tanks may travel

Before entering such an area, especially confined areas, check the atmosphere with an appropriate device.  
Vinyl chloride is a confirmed human carcinogen. Do not enter fire area without wearing specialized protective/equipment suitable for the situation. Firefighter's normal protective clothing (Bunker Gear) will not provide adequate protection. A full-body encapsulating chemical resistant suit with positive pressure self-contained breathing apparatus (MSHA/NIOSH approved or equivalent) may be necessary.

**\*\* NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD INDEX \*\***

NFPA - HEALTH	: 2 - Intense or continued (but not chronic) exposure could cause temporary incapacitation or possible residual injury.
NFPA - FLAMMABILITY	: 4 - Will rapidly or completely vaporize, or readily disperse in air and burn.
NFPA - REACTIVITY	: 2 - Readily undergoes violent chemical change at normal or elevated temperatures and pressures, or reacts violently with water, or may form explosive mixtures with water.

**\*\*\* SECTION 6. ACCIDENTAL RELEASE MEASURES \*\*\***

**SPILL PRECAUTIONS :**

Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. Wear adequate personal protective equipment. Ventilate area.  
Extinguish or remove all ignition sources. Remove or isolate flammable and combustible materials.  
Notify government occupational and environmental authorities.

**CLEAN-UP :**

Do not touch spilled material. Prevent material from entering sewers or confined spaces. Stop or reduce leak if safe to do so. Keep materials which can burn away from spilled material.  
SMALL SPILLS: Evacuate area and let evaporate.  
LARGE SPILLS: Contact fire and emergency services and supplier for advice.

**\*\*\* SECTION 7. HANDLING AND STORAGE \*\*\***

**HANDLING :**

This material is a VERY TOXIC (CANCER HAZARD, MUTAGEN), COMPRESSED, EXTREMELY FLAMMABLE GAS. The gas and uninhibited liquid are also DANGEROUSLY REACTIVE. Before handling, it is extremely important that engineering controls are operating and that protective equipment requirements and personal hygiene measures are being followed.  
Control access to designated handling area. Only authorized personnel should have access to this material. They should be properly trained regarding its hazards and its safe use. Maintenance and emergency personnel should be advised of potential hazards.  
Prevent the release of this material into the workplace air. Closed handling systems for processes involving this material should be used. To reduce the fire/explosion hazard, consider the use of an inert gas in the container or storage vessel.  
If a closed handling system is not possible, use in smallest possible amounts in a well ventilated area separate from the storage area.  
Eliminate all ignition sources (e.g. sparks, open flames, hot surfaces). Keep away from heat. Post "NO SMOKING" signs. It is very important to keep areas where this material is used clear of other materials which can burn (e.g., cardboard, sawdust).  
Immediately report leaks or ventilation failures.  
Unprotected persons should avoid all contact with liquid vinyl chloride. If vinyl chloride is released, immediately put on a suitable respirator

Follow the chemical supplier's/manufacture's advice on checking and maintaining appropriate levels of inhibitor in the liquid. Prevent exposure to air, sunlight or elevated temperatures because the gas may polymerize explosively. No contact with water.

Use non-sparking ventilation systems, approved explosion-proof equipment and intrinsically safe electrical systems in areas of use. Consider the installation of leak and fire detection equipment along with a suitable, automatic fire suppression system. Keep aisles and exits free of obstruction.

Do not use near welding operations, flames or hot surfaces. Do not perform any welding, cutting, soldering, drilling or other hot work on an empty vessel, container or piping until it has been thoroughly decontaminated. To prevent sparking, generously wet hard surfaces before they are chipped, ground, etc, in potentially hazardous areas. Do not heat compressed gas cylinders.

Inspect cylinders for leaks before handling. During transfer operations, cylinders and vessels should be electrically grounded and bonded to prevent the build-up of a static charge.

Do not use with incompatible materials such as strong oxidizing agents (e.g. nitrogen oxides, nitrates) and copper and its alloys. See Incompatibilities - Materials to Avoid section for more information. Leave cylinder cap on cylinder until cylinder is secured and ready for use. Always secure cylinders to a wall, rack or other solid structure in an upright position. Do not handle cylinders with oily hands.

Regularly check cylinders for evidence of corrosion or leakage. Make sure cylinders are labelled clearly. Use the appropriate pressure regulator. Ensure equipment is compatible with cylinder pressure and contents. Follow supplier recommendations.

Before connecting the cylinder for use, make sure that back feed from the system into the cylinder is prevented. Suck-back into cylinder may cause explosion. Prevent cylinder entry tube from being inserted in a liquid or gas without a vacuum-break or other protective device.

Avoid damaging cylinders. Do not open cylinder if damaged. Never use excessive force when opening. Open cylinder valve slowly to prevent rapid decompression and damage to valve seat. Keep cylinder valves clean and free from contaminants.

Make sure valves on gas cylinders are fully opened when gas is used. Open and shut valves at least once a day, while cylinder is in use, to avoid valve 'freezing'. Shut flow off at cylinder valve and not just at the regulator after use. Replace outlet caps or plugs and cylinder caps as soon as cylinder is disconnected from equipment.

Keep empty cylinders under slightly positive pressure. Do not use cylinders as rollers or for any other purpose than to contain the gas as supplied.

Move cylinders by hand truck or cart designed for that purpose. Do not drop cylinders or permit them to bang against each other. Do not lift cylinders by the cap or with a lifting magnet.

Follow handling precautions on Material Safety Data Sheet. Have suitable emergency equipment for fires and leaks readily available. Practice good housekeeping. Maintain handling equipment. Comply with applicable regulations.

#### STORAGE :

Store cylinders in a cool, dry, well-ventilated area, out of direct sunlight and away from heat and ignition sources. Store in an isolated fireproof building, if possible. If this is not possible, store in approved fireproof flammables storage room. Keep quantity stored as small as possible.

Storage facilities should be made of fire resistant materials. Use a grounded, non-sparking ventilation system, approved explosion-proof equipment and intrinsically safe electrical systems. For large scale operations, consider the installation of leak and fire detection equipment along with a suitable, automatic fire suppression system. Ground floor storage facilities are usually recommended, away from process and handling areas, eating areas, protective equipment storage, elevators and loading docks. Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Post warning signs. Inspect periodically for damage or

should not be allowed around indoor or outdoor storage areas. The storage area should be posted as a "NO SMOKING" area.

Store within temperature range recommended by chemical manufacturer/supplier. Alarms that warn of temperatures higher or lower than recommended may be necessary. Outdoor cylinder storage should be weatherproofed and have proper drainage. Protect from temperature extremes. (Never expose cylinders to temperatures higher than 52 deg C (125 deg F) or below -29 deg C (-20 deg F) unless they are designed for this. Follow supplier's advice for storage temperatures. Compressed gas cylinders should be stored separately according to their chemical hazards. Check compatibility with other materials including other compressed gases. Keep apart at the appropriate distance, as recommended by the supplier, by regulation or in relevant NFPA or other standards. Store away from oxidizers and corrosives and other incompatible materials such as copper and its alloys. See Incompatibilities - Materials to Avoid section for more information. Inspect all incoming cylinders to make sure they are properly labelled and not damaged. Always check cylinder valve for evidence of damage, rust or dirt which may inhibit operation. Check that the cylinder was last tested within the required time. Cylinder valves should be tightly closed. Cylinder valve caps should be properly secured. Always chain or otherwise securely restrain cylinders in an upright position to a wall, rack or other solid structure when they are stored. Keep empty cylinders in separate storage area. Empty cylinders may contain hazardous residues. Keep closed. Store empty cylinders with valves shut off, cap secure and labelled EMPTY. Store flammable, toxic gases according to occupational health and safety regulations and fire and building codes which will describe the kind of storage area and the type of storage containers for a specified amount of the material. Follow any special instructions for storage on Material Safety Data Sheet (e.g. maximum storage quantities).

### \*\*\* SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION \*\*\*

NOTE : Exposure to this material can be controlled in many ways. The measures appropriate for a particular worksite depend on how this material is used and on the extent of exposure. This general information can be used to help develop specific control measures. Ensure that control systems are properly designed and maintained. Comply with occupational, environmental, fire, and other applicable regulations.

#### SAMPLING AND ANALYSIS :

Use appropriate instrumentation and sampling strategy (location, timing, duration, frequency and number of samples). Interpretation of the sampling results is related to these variables and the analytical method. Sampling should be carried out by trained personnel.

OSHA METHOD 75 - OSHA analytical methods manual. 2nd edition. Part 1. Volume 3. US Department of Labor, January 1990. Fully validated method. Collection on carbosieve S-III (molecular sieve) sorbent tube. Desorption with carbon disulfide (CS<sub>2</sub>)/dimethylformamide (99/1) in the presence of magnesium sulfate. Analysis by gas chromatography using flame ionization detector (FID). Detection limit of 0.020 ppm (0.051 mg/m<sup>3</sup>) (reliable limit).

NIOSH METHOD 1007 - NIOSH manual of analytical methods. 4th edition. Volume 3. Fully evaluated method. Collection on 2 coconut shell activated charcoal sorbent tubes in series. Desorption with carbon disulfide (CS<sub>2</sub>). Analysis by gas chromatography using flame ionization detector (FID). Estimated detection limit of 0.04 micrograms (ug).

DIRECT READING INSTRUMENTS: Methods of detection in commercially available devices which may be suitable: Infrared spectrometer, gas chromatograph analyzer, photoionization detector, electron capture gas

#### ENGINEERING CONTROLS :

Engineering control methods to reduce hazardous exposures are preferred and are required in some jurisdictions. Methods include mechanical ventilation (dilution and local exhaust), process or personnel enclosure, control of process conditions and process modification (e.g. substitution of a less hazardous material). Administrative controls and personal protective equipment may also be required.

Because of the high potential hazard associated with this substance, stringent control measures such as enclosure (closed handling systems) are recommended. To reduce the fire hazard, consider the use of an inert gas in the handling system.

Fittings should not be made from copper or copper alloys (e.g. brass). Stainless steel is recommended.

Use non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Exhaust directly to the outside. Supply sufficient replacement air to make up for air removed by exhaust systems. Use approved explosion-proof equipment and intrinsically safe electrical systems in areas of use. Consider the installation of leak and fire detection equipment along with a suitable, automatic fire suppression system.

#### PERSONAL PROTECTIVE EQUIPMENT :

If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protective equipment including approved respiratory protection. Have appropriate equipment available for use in emergencies such as spills or fire.

If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection. Refer to the CSA Standard Z94.4-93, "Selection, Use and Care of Respirators," available from the Canadian Standards Association, Rexdale, Ontario, M9W 1R3.

#### RESPIRATORY PROTECTION GUIDELINES :

NIOSH RECOMMENDATIONS FOR VINYL CHLORIDE CONCENTRATIONS IN AIR (35):

AT CONCENTRATIONS ABOVE THE NIOSH REL, OR WHERE THERE IS NO REL, AT ANY DETECTABLE CONCENTRATION: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

ESCAPE: Gas mask with canister to protect against vinyl chloride; or escape-type SCBA.

NOTE: NIOSH has classified this material as a potential occupational carcinogen, according to specific NIOSH criteria, with no recommended exposure limit (REL). This classification is reflected in these recommendations for respiratory protection, which specify that only the most reliable and protective respirators be worn at any detectable concentration. The requirements in Canadian jurisdictions may vary.

Recommendations apply only to NIOSH approved respirators.

The respirator use limitations specified by the approving agency and the manufacturer must be observed.

ABBREVIATIONS: SAR = supplied-air respirator; SCBA = self-contained breathing apparatus.

#### EYE/FACE PROTECTION :

Chemical safety goggles. A face shield may also be necessary.

#### SKIN PROTECTION :

Chemical protective gloves, coveralls, boots and/or other resistant protective clothing. Have a safety shower/eye-wash fountain readily available in the immediate work area. A chemical protective full-body encapsulating suit and respiratory protection may be required in some operations.

#### RESISTANCE OF MATERIALS FOR PROTECTIVE CLOTHING :

RECOMMENDED (resistance of breakthrough longer than 8 hours): Barricade (TM), CPF 3 (TM), Tychem 10000 (TM).

RECOMMENDED (resistance of breakthrough longer than 4 hours): Nitrile rubber. Teflon (TM). Viton (TM).

Butyl rubber, natural rubber, neoprenopolyvinyl chloride.(36)

There is evidence that this chemical can cause serious skin injury (e.g., corrosion or absorption hazard). Recommendations are NOT valid for very thin Natural rubber, Neoprene, Nitrile and PVC gloves (0.3 mm or less). Recommendations are valid for permeation rates reaching 0.1 ug/cm2/min or 1 mg/m2/min and over. Resistance of specific materials can vary from product to product. Breakthrough times are obtained under conditions of continuous contact, generally at room temperature. Evaluate resistance under conditions of use and maintain clothing carefully.

PERSONAL HYGIENE :

Remove wet clothing immediately. Keep contaminated clothing in closed containers. Discard or launder before rewearing. Inform laundry personnel of contaminant's hazards.  
Do not smoke, eat or drink in work areas. Maintain good housekeeping.

\*\* EXPOSURE GUIDELINES \*\*

\* THRESHOLD LIMIT VALUES (TLVs) / AMERICAN CONFERENCE OF  
GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH) / 2002 \*

TIME-WEIGHTED AVERAGE (TLV-TWA) : 1 ppm (2.6 mg/m3) - Carcinogenicity  
Designation A1

TLV BASIS - CRITICAL EFFECT(S) : Cancer

TLV COMMENTS :

CARCINOGENICITY DESIGNATION A1 - Confirmed Human Carcinogen: Substance is carcinogenic to humans based on convincing evidence from human studies. For a substance assigned a TLV, exposure should be controlled to levels as low as reasonably achievable below the TLV. Workers exposed to a substance without an assigned TLV should be properly equipped to eliminate virtually all exposure to it.

NOTE: In many jurisdictions, exposure limits are similar to the ACGIH TLVs. Since the manner in which exposure limits are established, interpreted and implemented can vary, obtain detailed information from the appropriate government agency in each jurisdiction.

NOTE: Many jurisdictions have specific regulations regarding worksite exposure to **vinyl chloride**. Obtain detailed information from the appropriate government agency in each jurisdiction.

\* PERMISSIBLE EXPOSURE LIMITS (PELs) / FINAL RULE LIMITS /  
US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) \*

TIME-WEIGHTED AVERAGE (PEL-TWA) : See below\*

FINAL RULE LIMIT PEL COMMENTS :

\*This chemical is specifically regulated in 29 CFR 1910.1017. TIME WEIGHTED AVERAGE: 1 ppm; SHORT TERM EXPOSURE LIMIT: 5 ppm; ACTION LEVEL: 0.5 ppm. CANCER SUSPECT AGENT. Refer to the regulation for additional information.

NOTE: The OSHA PEL Final Rule Limits are currently non-enforceable due to a court decision. The OSHA PEL Transitional Limits are now in force.

\* PERMISSIBLE EXPOSURE LIMITS (PELs) / TRANSITIONAL LIMITS /  
US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) \*

TIME-WEIGHTED AVERAGE (PEL-TWA) : See below\*

TRANSITIONAL LIMIT PEL COMMENTS :

\*NOTE: This chemical is specifically regulated in 29 CFR 1910.1017. Refer to PEL comments above for information.

1 ppm = 2.55 mg/m<sup>3</sup>; 1 mg/m<sup>3</sup> = 0.392 ppm at 25 deg C (calculated)

MELTING POINT : -154 deg C (-245 deg F) (22,23,26)

BOILING POINT : -13.4 deg C (7.9 deg F) (22,26,28)

RELATIVE DENSITY (SPECIFIC GRAVITY) :  
0.908 at 21.1 deg C (22); 0.969 at -14.4 deg C (26,28) (water = 1)  
(liquid)

SOLUBILITY IN WATER :  
Slightly soluble in water (110 mg/100 g (26,32); 276 mg/100 mL (4) at 25 deg C)

SOLUBILITY IN OTHER LIQUIDS :  
Very soluble in diethyl ether; soluble in ethanol, benzene, hydrocarbons, chlorinated solvents, oil and most common organic liquids. (13,26,32)

COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT) :  
Log P(oct) = 0.6 (calculated) (27); 1.36 (estimated) (32); 1.99 (estimated) (4)

pH VALUE : Not available

VAPOUR DENSITY : 2.15 at 15 deg C (air = 1) (22)

VAPOUR PRESSURE : 78 kPa (585 mm Hg) at -20 deg C (26,28); 31 kPa (2500 mm Hg) at 20 deg C (28); 756 kPa (5670 mm Hg) at 50 deg C (2)

SATURATION VAPOUR CONCENTRATION : Not applicable at normal temperatures; gas

EVAPORATION RATE : Not applicable at normal temperatures; gas

CRITICAL TEMPERATURE : 158.4 deg C (317.1 deg F) (22)

OTHER PHYSICAL PROPERTIES :  
VISCOSITY-DYNAMIC: 0.273 mPa.s (0.273 centipoise) at -20 deg C (liquid) (26)  
VISCOSITY-KINEMATIC: 0.30 mm<sup>2</sup>/m (0.30 centistokes) at -20 deg C (calculated)  
VISCOSITY-DYNAMIC: 0.01072 mPa.s (0.01072 centipoise) at 20 deg C and 101.33 (gas) (27)  
SURFACE TENSION: 23.1 mN/m (23.1 dynes/cm) at -20 deg C (27)  
CRITICAL PRESSURE: 5341 kPa abs. (774.7 psia or 52.7 atm.) (22)  
TRIPLE POINT: -151.5 deg C (-240.7 deg F) at 0.00124 kPa abs (estimated). (22)

### \*\*\* SECTION 10. STABILITY AND REACTIVITY \*\*\*

#### STABILITY :

Unstable. The liquid can be stabilized with an inhibitor and in the absence of air and oxygen. The gas may polymerize explosively. Unstable peroxides can form on standing in air, especially in the presence of iron impurities which may arise from the corrosion of cast iron and steel storage containers. (26) Reacts with water to form hydrochloric acid. (28)

#### HAZARDOUS POLYMERIZATION :

Uninhibited **vinyl chloride** or material that is depleted of inhibitor can polymerize violently when exposed to air, sunlight (ultraviolet light), elevated temperatures, and the presence of incompatible materials, such as peroxides and other oxidizing materials. (22,23,29,30) **Vinyl chloride** tends to self-polymerize explosively if peroxidation occurs, and several industrial explosions have occurred. (31)

#### INCOMPATIBILITY - MATERIALS TO AVOID :

AIR or OXYGEN (especially in the presence of iron impurities) - forms an unstable polyperoxide, which can explode. (29,31)  
STRONG OXIDIZING AGENTS (e.g. nitrogen oxides, nitrates, peroxides, perchlorates, permanganates) - can cause violent polymerization increasing risks of fire and explosion. (23,31)  
COPPER AND ITS ALLOYS - may form explosive acetylides from trace impurities of acetylene present in **vinyl chloride**. (22,23,25)  
WATER - reacts to form hydrochloric acid. (28)

#### HAZARDOUS DECOMPOSITION PRODUCTS :

Peroxides, hydrochloric acid

#### CONDITIONS TO AVOID :

Open flames, sparks, electrostatic discharge, heat and other ignition sources, air, sunlight, low inhibitor concentration and moisture.

#### CORROSIVITY TO METALS :

cast iron, steel, copper and its alloys, and aluminum, especially at elevated temperatures.(22,33) It does not corrode type 316 stainless steel, which is a satisfactory material to use with vinyl chloride.(22,33) /RCM/

\*\*\* SECTION 11. TOXICOLOGICAL INFORMATION \*\*\*

LC50 (rat): 33700 ppm (4-hour exposure); cited as 47640 ppm (2-hour exposure) (19)

LC50 (mouse): 19400 ppm (4-hour exposure); cited as 27420 ppm (2-hour exposure) (19)

EYE IRRITATION: Eye irritation has not been observed in animals exposed to very high concentrations of the gas.(4)

EFFECTS OF SHORT-TERM (ACUTE) INHALATION: There is a marked difference in species susceptibility, but all species studied experienced central nervous system (CNS) effects. Initially, there is excitation followed by incoordination, drowsiness, unconsciousness, convulsions and accelerated respiration progressing to respiratory failure and death.(4,6) Other changes have been reported following brief exposures to very high concentrations (over 100000 ppm), including marked congestion and bleeding of the lungs (guinea pigs), irregular heart beat (dogs), blood clotting failure (guinea pigs), liver damage and kidney congestion (mice). Lower exposures (50000 ppm) had no observable effects on the liver, kidneys, or nervous system in rats.(4)

EFFECTS OF LONG-TERM (CHRONIC) INHALATION : In studies using relatively low concentrations (up to 500 ppm), the major finding has been liver toxicity. Necrosis of the liver was observed in rabbits exposed to 200 ppm vinyl chloride for 6 months. No significant effects were observed in rats, rabbits and guinea pigs exposed to 50 ppm for 6 months.(20) Rats exposed to 10 ppm for 6 months developed increased heart and kidney weights. Increased mortality has been reported with exposures from 50 to 250 ppm for 6 to 12 months.(4) However, statistical analysis of the data was not reported.(4)

Many other studies have been conducted with higher exposure levels (over 2500 ppm). In these studies, harmful changes were observed in the respiratory system, the liver, the heart and blood vessels, the kidneys, and the nervous system.(4,7)

CARCINOGENICITY: All of the many animal studies reported have been positive for cancer following exposure by any route. The International Agency for Research on Cancer (IARC) has concluded that there is sufficient evidence for carcinogenicity in animals. While there are weaknesses in the reporting and/or conduct of many of studies, the occurrence of cancer is consistently observed.(4,5,8,12) The minimum carcinogenic dose varies by species, but is as low as 10 ppm for rats and 50 ppm for mice.(5)

A few studies have examined the possibility that exposure of pregnant animals may result in an increased incidence of cancer in the offspring. No conclusions can be drawn from these studies because of design flaws, such as not using a control group, not conducting statistical evaluation of the results and/or the observation of high mortality in the test animals.(4,21)

TERATOGENICITY AND EMBRYOTOXICITY: The available information suggests that vinyl chloride does not cause embryotoxicity or teratogenicity at doses that are not maternally toxic.

No conclusions can be drawn from two studies with low exposure levels (15 ppm or less) because the studies were not well conducted or reported. In studies with higher exposure levels (50 to 2500 ppm), developmental effects (for example, reduced fetal weight, delayed ossification, reduced litter size) were observed in mice, rats and rabbits at concentrations that were also maternally toxic. No firm conclusions can be drawn from the one study that showed reduced litter size because only a single concentration of vinyl chloride was tested.(4)

male rats exposed to 100 or 500 ppm for 12 or 10 months, respectively.(4) No conclusions can be drawn from another study in which male rats were exposed to 250 ppm or 1000 ppm for 11 weeks. A significant reduction in the number of pregnant females was noted, but a statistically significant decrease in the number of fertile males was not observed. There was no evidence of pre- or post- implantation loss of embryos in the females.(34) The study did not comment on the presence or absence of toxicity in the exposed animals.

MUTAGENICITY: Vinyl chloride gas has produced positive results in the somatic cells of live animals in several studies. Negative results have been obtained in dominant lethal tests using rats or mice. Positive results have been produced in bacteria and cultured mammalian cells, usually in the presence of metabolic activation.(4,12,18,37)

### \*\*\* SECTION 12. ECOLOGICAL INFORMATION \*\*\*

NOTE : Inclusion of Ecological Information on an MSDS is optional under the US Hazard Communication Standard and the Canadian Controlled Products Regulations (WHMIS). In other jurisdictions, inclusion of Ecological Information may be a requirement. For specific requirements, contact the relevant regulatory authorities in the jurisdiction where the MSDS is intended to be used.

The American National Standard for Hazardous Industrial Chemicals - Material Safety Data Sheets - Preparation (ANSI 2400.1-1998) provides advice on data that could be included in this section, as well as ecotoxicological tests and issues.

Databases in CCOHS's CD-ROM and Web collection which contain useful Ecological Information include CESARS, HSDB(R) (Hazardous Substances Data Bank) and CHRIS (Chemical Hazards Response Information System).

### \*\*\* SECTION 13. DISPOSAL CONSIDERATIONS \*\*\*

Review federal, provincial and local government requirements prior to disposal. Store material for disposal as indicated in above Storage Conditions. Disposal by controlled incineration with a scrubber attached to remove any hydrochloric acid formed.

### \*\*\* SECTION 14. TRANSPORT INFORMATION \*\*\*

#### \*\* CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG) SHIPPING INFORMATION \*\*

SHIPPING NAME AND DESCRIPTION: VINYL CHLORIDE, STABILIZED  
UN NUMBER: UN1086  
CLASS: 2.1  
PACKING GROUP/RISK GROUP: ---  
SPECIAL PROVISIONS: ---  
PASSENGER CARRYING ROAD/RAIL LIMIT: Forbidden  
MARINE POLLUTANT: ---

NOTE: This information incorporates the Transportation of Dangerous Goods Regulations SOR/2001-286, effective August 1, 2002.

#### \*\* US DEPARTMENT OF TRANSPORT (DOT) HAZARDOUS MATERIALS SHIPPING INFORMATION (49 CFR) \*\*

HAZARDOUS MATERIAL DESCRIPTION AND PROPER SHIPPING NAME: Vinyl chloride, inhibited Vinyl chloride, stabilized  
HAZARD CLASS OR DIVISION: 2.1  
IDENTIFICATION NUMBER: UN 1086  
PACKING GROUP: ---

NOTE : This information was taken from the US Code of Federal

\*\*\* SECTION 15. REGULATORY INFORMATION \*\*\*

\*\* CANADIAN WORKPLACE HAZARDOUS MATERIALS  
INFORMATION SYSTEM (WHMIS) \*\*

PROPOSED WHMIS CLASSIFICATION :

A - Compressed gas  
B1 - Flammable and combustible material - Flammable gas  
D2A - Poisonous and infectious material - Other effects - Very toxic  
D2B - Poisonous and infectious material - Other effects - Toxic  
F - Dangerously reactive material

WHMIS HEALTH EFFECTS :

Chronic toxicity - toxic - other  
Carcinogenicity - very toxic - other  
Mutagenicity - toxic - other

WHMIS INGREDIENT DISCLOSURE LIST :

Included for disclosure at 0.1% or greater

DETAILED WHMIS CLASSIFICATION ACCORDING TO CRITERIA :

CLASS A - COMPRESSED GAS: Meets criteria for a compressed gas; TDG class 2.1; vapour pressure 756 kPa (7.46 atm.) at 50 deg C.  
CLASS B - FLAMMABLE & COMBUSTIBLE MATERIAL: Meets criteria for "Flammable Gas"; TDG class 2.1; forms flammable mixtures with air over a concentration range greater than 12% by volume (29.4%); forms flammable mixture with air at a concentration of 13% by volume or less (3.6-4%).  
CLASS C - OXIDIZING MATERIAL: Does not meet criteria.  
CLASS D - POISONOUS AND INFECTIOUS MATERIAL. DIVISION 1 - IMMEDIATE AND SERIOUS TOXIC EFFECTS: Does not meet criteria.  
Acute Lethality: Does not meet criteria; LC50 (mouse): 19400 ppm (4-hour exposure); cited as 27420 ppm (2-hour exposure).  
CLASS D - POISONOUS AND INFECTIOUS MATERIAL. DIVISION 2 - OTHER TOXIC EFFECTS: Meets criteria for "Very toxic material". See detailed evaluation below.  
Chronic Health Effects: "Toxic"; necrosis of the liver observed in rabbits exposed to 200 ppm for 6 months; increased mortality has been reported with exposures from 50 to 250 ppm for 6 to 12 months.  
Carcinogenicity: "Very toxic"; IARC Group 1 and ACGIH A1 carcinogen.  
Teratogenicity and Embryotoxicity: Probably does not meet criteria; vinyl chloride does not cause embryotoxicity or teratogenicity in animals at doses that are not maternally toxic.  
Reproductive Toxicity: Insufficient information; no conclusions can be drawn from the available human and animal information.  
Mutagenicity: "Toxic"; positive results (chromosomal aberrations) in the cells of workers with high exposure. Positive results in the somatic cells of live animals.  
Respiratory Sensitization: Does not meet criteria; not reported as human respiratory sensitizer.  
Skin Sensitization: Insufficient information.  
Skin Irritation: Does not meet criteria; gas.  
Eye Irritation: Does not meet criteria; gas.  
CLASS E - CORROSIVE MATERIAL: Does not meet criteria.  
CLASS F - DANGEROUSLY REACTIVE MATERIAL: Gas or uninhibited liquid meet criteria. Vinyl chloride liquid is sold inhibited to prevent polymerization, but it readily forms a gas.

\*\* US OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)  
HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) \*\*

OSHA HAZARD COMMUNICATION EVALUATION :

Meets criteria for hazardous material, as defined by 29 CFR 1910.1200.

\*\* EUROPEAN UNION (EU)  
CLASSIFICATION AND LABELLING INFORMATION \*\*

EU CLASSIFICATION :

Extremely flammable. Carcinogenic category 1. [F+;carc. cat. 1] (37)

Avoid exposure - obtain special instruction before use. In case of accident or if you feel unwell, seek medical advice immediately (show label where possible). [S:53-45]

EU COMMENTS :

The product label must indicate if the substance is in a non-stabilized form.

\*\*\* SECTION 16. OTHER INFORMATION \*\*\*

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REVIEW/PREPARATION DATE :

1997-12-02

REVISION INDICATORS :

Resistance of materials; 1998-02-01

Transport (US); 1998-02-01

Bibliography; 1999-02-01

TLV-TWA; 1999-03-01

TLV comments; 1999-03-01

TDG; 2002-05-29

\*\*\* END OF RECORD \*\*\*

## *Appendix D*

### *Safety and Health Forms*

### **Acknowledgment of Accident Prevention Plan**

**I certify that I have read and understand the contents of the Accident Prevention Plan and its appendices.**

[illegible]

**Sevenson Environmental Services, Inc.**  
**Certificate of Decontamination**

EQUIPMENT:

EQUIPMENT NUMBER:

DATE DECONTAMINATED:

PROCEDURE USED:

\_\_\_\_\_  
(Site Safety Officer)

# Sevenson Environmental Services, Inc.

## CONFINED SPACE PERMIT

Date \_\_\_\_\_ Time of Issue \_\_\_\_\_ Length of Permit \_\_\_\_\_  
 Location \_\_\_\_\_ Equipment ID \_\_\_\_\_  
 Purpose of Entry & Description of Work \_\_\_\_\_

Authorized Entrant(s) \_\_\_\_\_  
 Will "HOT" Work be authorized for this Entry? \_\_\_\_\_ No \_\_\_\_\_ Yes (describe) \_\_\_\_\_

### HAZARDOUS IDENTIFICATION

Indicate ALL potential Hazards of this Permit Space: YES N/A  
 a. Contains or may contain a hazardous atmosphere \_\_\_\_\_  
 b. Contains a material for potential engulfment \_\_\_\_\_  
 c. Has an internal configuration for potential entrapment \_\_\_\_\_  
     If "Yes", describe \_\_\_\_\_  
 d. Contains the following serious safety or health Hazards: \_\_\_\_\_

### PRE-ENTRY PREPARATION

		YES	N/A	Done			Removed		
				Date	Time	By	Date	Time	By
1. Lines broken and/or blanked:									
Line Contents	Location								
a.									
b.									
c.									
2. Drain or at a workable level									
3. Purge - flush and vent									
4. Force air to bottom & vent									
5. Lock out power feeds:									
Equip/Location of Lock out									
a.									
b.									
c.									
6. Shut-off heating systems									
7. Other:									

NOT TO BE TAKEN

	P.E.L.	Time		Time	Time	Time
		Tester		Tester	Tester	Tester
		Yes	N/A	Results	Results	Results
% of Oxygen	19.5% to 23%					
Temperature	110°F/43°C					
% of LEL	Any % over 10					
Hydrogen Sulfide	10 ppm					

#### PREVENTION OF UNAUTHORIZED ENTRY

1. Have Worker(s) to enter been trained for this specific entry? YES  
 2. Have Attendants been trained for this specific space? \_\_\_\_\_  
 3. Post "WORKER IN CONFINED SPACE" Sign \_\_\_\_\_  
 4. Set-up the following additional barriers: \_\_\_\_\_  
 \_\_\_\_\_

#### MANDATORY SAFETY EQUIPMENT REQUIRED

- |                                    | YES   | N/A   |
|------------------------------------|-------|-------|
| 1. Fire Extinguisher               | _____ | _____ |
| 2. Retrieval Lines                 | _____ | _____ |
| 3. Respirator                      | _____ | _____ |
| 4. Goggles                         | _____ | _____ |
| 5. Hearing Protection              | _____ | _____ |
| 6. Protective Clothing             | _____ | _____ |
| 7. Special Boots or Shoes          | _____ | _____ |
| 8. Gloves                          | _____ | _____ |
| 9. Other Safety Equipment Required | _____ | _____ |

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

#### COMMUNICATION PROCEDURES AND EQUIPMENT TO BE USED FOR THIS ENTRY

(Verify that chosen equipment is in place and operation.)

1. \_\_\_\_\_ Verified by: \_\_\_\_\_  
 2. \_\_\_\_\_

**RESCUE EQUIPMENT TO BE PROVIDED ON-SITE**

	YES	N/A
a. Two chest harnesses or two wristlets	_____	_____
b. Two five minute supplied air escape respirators	_____	_____
c. One 30 minute S.C.B.A.	_____	_____
d. One emergency siren	_____	_____
e. Man basket	_____	_____
f. Retrieval wench	_____	_____
g. Other necessary Rescue Equipment	_____	_____

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**IN CASE OF EMERGENCY**

Rescue Service	Phone Number or Ext.
1. _____	_____
2. _____	_____
3. _____	_____

**Authorizer** must sign below AFTER all the above actions are fully understood and conditions necessary for SAFE entry have been met.

**Authorizer of Entry** \_\_\_\_\_  
Signature Date Time

Upon completion of the entry covered by this Permit, and after all entrants have exited the Permit space, **Authorizer** must sign below.

**Canceled by** \_\_\_\_\_  
Signature Date Time

# Sevenson Environmental Services, Inc.

## Daily Air Monitoring Report

Project Number:	Project Name:	Project Supervisor
-----------------	---------------	--------------------

Date:	Duration of Monitoring
-------	------------------------

Work Location and Task:
-------------------------

Instrument:		Instrument:		Instrument:	
Reading	Time	Reading	Time	Reading	Time

Calibration:	Calibration:	Calibration:
--------------	--------------	--------------

Perimeter Samples Collected:
------------------------------

Personnel Samples Collected:
------------------------------

Perimeter and Personnel Sample Results from Previous Day (Provide Data when Received):
--

Comments:
-----------

Name:	Title:
-------	--------

Signature:	Date:
------------	-------

### Daily Air Monitoring Report (Cont.)

Project Number:

Project Name:

Project Supervisor

Instrument:

**Instrument:**

Instrument:

## Reading

# Time

## Reading

## Time

## Reading

Time

**Calibration:**

**Calibration:**

**Calibration:**

**Signature:**

Date: \_\_\_\_\_

**Sevenson Environmental Services, Inc.**  
*Daily Safety Meeting*

DATE:

DAY:

**JOB NAME:**  
**& NUMBER:**

**TOPIC:**

•

•

•

•

\_\_\_\_\_

**Additional Notes:**

(attach detailed safety meeting minutes to this form)

**Additional Notes:**

(attach detailed safety meeting minutes to this form)

(attach detailed safety meeting minutes to this form)

PRINT	SIGNATURE:
-------	------------

[illegible][illegible]

[illegible]

Date: \_\_\_\_\_

**PRINT**

**SIGNATURE:**

**Sevenson Environmental Services, Inc.**  
**DAILY SAFETY REPORT**

DATE:

WORK PERIOD COVERED:

WEATHER CONDITIONS:

SUMMARY OF DAY'S WORK ACTIVITY:

EQUIPMENT UTILIZED BY SAFETY MONITORS:

PROTECTIVE CLOTHING AND EQUIPMENT BEING USED BY TASK:

PHYSICAL CONDITION OF WORKERS (any heat or cold stress or other medical problems):

ACCIDENTS OR BREACH OF PROCEDURES:

DESCRIPTION OF MONITORING AND AIR SAMPLES TAKEN:

TYPE AND NUMBER OF PERMITS ISSUED:

SUMMARY OF TRAINING AND SAFETY MEETING:

This report is typed. Cell size will  
be adjusted to fit text.

NAME:

TITLE: Site Safety and Health Officer

SIGNATURE:

Cornell Dubilier Superfund Site  
Sling Inspection Matrix

Today's Date March 6, 2009

Sling Number	Type	Sling Serial Number	Inspected By	Date Inspected	Inspection Due	Inspection Current	Pass/Fail	Last Inspection	Comments
1	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...
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96	...	...	...	...	...	...	...	...	...
97	...	...	...	...	...	...	...	...	...
98	...	...	...	...	...	...	...	...	...
99	...	...	...	...	...	...	...	...	...
100	...	...	...	...	...	...	...	...	...

<b>Sevenson Environmental Services, Inc.</b> <b>EMPLOYEE &amp; VISITOR LOG</b>
---

DATE: \_\_\_\_\_

[illegible]

Project Number:	Project Name:	Project Supervisor:
-----------------	---------------	---------------------

Comments:
-----------

<b>Site Safety and Health Officer</b>	<b>Signature</b>

**Sevenson Environmental Services, Inc.**  
**PERMIT FOR OPEN FLAME OR WELDING**

I. Job description and equipment used:

II. Monitoring:

Date and Shift	Time	O <sub>2</sub>	LEL	Organic Vapor

III. Fire Protection

a. Fire extinguishers in place

(Initials) \_\_\_\_\_

b. Area clear of other combustible

(Initials) \_\_\_\_\_

IV. Operations in compliance with OSHA regulations (Initials) \_\_\_\_\_

This Permit is only valid for 4 hours from the time of the last air test or major change in conditions. A new Permit must be issued if hot work is to extend past the current work shift.

Authorized Signature \_\_\_\_\_

**Sevenson Environmental Services, Inc.  
RESPIRATOR FIT TEST RECORD**

**EMPLOYEE NAME:**

**DATE:**

**RESPIRATOR MANUFACTURE:  
RESPIRATOR SIZE:**

**RESULTS**

	Isoamyl Acetate	Irritant Smoke	Other
FIT			
NO FIT			
COMFORT:	Very Comfortable ____	Comfortable ____	Tolerable ____
	Uncomfortable ____	Very Uncomfortable ____	

**COMMENTS:**

**EMPLOYEE SIGNATURE:**

**Sevenson Environmental Services, Inc.  
RESPIRATOR FIT TEST RECORD**

**EMPLOYEE NAME:**

**DATE:**

**RESPIRATOR MANUFACTURE:  
RESPIRATOR SIZE:**

**RESULTS**

	Isoamyl Acetate	Irritant Smoke	Other
FIT			
NO FIT			
COMFORT:	Very Comfortable ____	Comfortable ____	Tolerable ____
	Uncomfortable ____	Very Uncomfortable ____	

**COMMENTS:**

**EMPLOYEE SIGNATURE:**

## *Appendix E*

### *Confined Space Entry Program*

# CONFINED SPACE ENTRY PROGRAM

## Purpose

The purpose of this procedure is to protect the health and safety of personnel working within confined spaces and to comply with all applicable regulations.

## Definitions

**Attendant** - a trained individual stationed outside a permit space who monitors the authorized entrants and performs all attendant's duties assigned in the facility permit space program.

**Authorized Entrant** - an individual who is authorized by facility management to enter a permit space.

**Blanking or Blinding** - the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

**Certified** - Written authorization by facility management for an individual to perform certain function(s) for which she/he has achieved certification. To become certified, an individual must satisfactorily complete all certification requirements as specified by facility management, such as but not limited to: participating in all required lectures and/or training; and attaining qualification in the required examination(s), drill(s), and/or field evaluation(s).

**Confined Space** - a space that:

1. Is large enough and so configured that an employee can bodily enter and perform assigned work; and
2. Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits); and
3. Is not designed for continuous human occupancy.

Examples of spaces that may meet the above criteria:

- |             |            |           |                     |
|-------------|------------|-----------|---------------------|
| • boilers   | • tanks    | • vessels | • ventilation ducts |
| • silos     | • hoppers  | • pits    | • storage bins      |
| • vaults    | • sewers   | • tunnels | • exhaust ducts     |
| • pipelines | • trenches |           |                     |

**Non-Permit Confined Space** - a confined space that does not contain or, respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical

harm. (Examples of spaces which could be considered as non-permit required spaces include water tanks, vessels that contained silica sand, brine tanks, pits, trenches, and diked areas.)

**Permit-Required Confined Space (Permit Space)** - a confined space that has one or more of the following characteristics.

1. Contains or has a potential to contain a hazardous atmosphere: flammable, toxic, and/or oxygen deficient;
2. Contains a material that has the potential for engulfing an entrant;
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
4. Contains any other recognized serious safety or health hazard.

**Double Block and Bleed** - a method used to isolate a confined space from a line, duct or pipe by physically locking closed two in-line valves on a system and locking open a "vented to atmosphere" valve between them.

**Engulfment** - the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

**Entry** - the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

**Entry Supervisor (Permit Issuer)** - the person, certified by management, responsible for:

- determining if acceptable entry conditions are present at a permit space where entry is planned;
- authorizing entry, and
- overseeing entry operations, and
- terminating entry as required by this procedure.

**Hazardous Atmosphere** - an atmosphere that may expose personnel to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

1. Flammable gas, vapor, or mist in excess of 10% of its lower flammable limit (LFL);
2. Airborne combustible dust at a concentration that meets or exceeds its LFL;

Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.

3. Atmospheric oxygen concentration below 19.5% or above 23%.
4. Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, and which could result in employee exposure in excess of its dose or permissible exposure limit.
5. Any other atmospheric condition that is immediately dangerous to life or health.

**Immediately Dangerous to Life or Health (IDLH)** - any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Note: Some materials - hydrogen fluoride gas and cadmium vapor, for example - may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12-72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.

**Inerting** - the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

**Oxygen Deficient Atmosphere** - an atmosphere containing less than 19.5% oxygen by volume.

**Oxygen Enriched Atmosphere** - an atmosphere containing more than 23% oxygen by volume.

**Prohibited Condition** - any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

**Rescue Services** - a defined group of trained individuals designated to rescue employees from confined spaces.

**Retrieval System** - the equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor used for non-entry rescue of persons from permit spaces.

**Testing** - the process by which the hazards that may confront entrants or a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the confined space.

## General Requirements

- An evaluation will be made at all job sites by the Health and Safety Officer if there are any permit required confined spaces.
- If these spaces are found, all employees will be notified at the initial site specific training.
- If the following conditions are met, then a less stringent entry procedure can be followed:
  - The only hazard is an actual or potentially hazardous atmosphere.
  - Forced air ventilation is sufficient to maintain safe entry.
  - Sufficient monitoring and inspection data are available.
- Classification of a non-permit confined space.
  - Has no actual or potential hazardous atmospheres.
  - Documentation that no hazardous atmospheres exist.
- Permit required confined space require:
  - Isolating the space - lock out/tag out, line breaking (follow procedures in Corporate Health and Safety Program); blanking or blinding, double blocks and bleeds, and disconnecting all mechanical linkages.
  - Purging, flushing, inerting or ventilating.
  - Verifying that conditions are acceptable for entry throughout the duration of an authorized entry.
- Preparation for entry.
  - Equipment needed include - air monitoring instrumentation, air moving equipment, communication, personnel protective equipment, illumination, barriers to protect entrants from external hazards, retrieval systems, and rescue and emergency equipment.
- Confined space entry permits.
  - No person will enter a confined space until a confined space entry permit has been completed.
  - Figure 1 shows a sample permit.
  - Only personnel trained and certified as entry supervisors may issue the permit.

- A copy of the permit must be posted until the permit is canceled.
- Permit will be valid for the period required to complete the assigned task or for 24 hours whichever is less.
- Testing of the atmosphere.
  - Tests for a flammable atmosphere, oxygen deficiency, and vapor concentration (if applicable) will be conducted.
  - Oxygen content between 19.5 and 23%, Lower Flammability Level <1%, and vapor concentration less than the OSHA exposure level are acceptable for entry.
  - Sufficient tests must be taken through a cross-section of the confined space to accurately characterize the environment.
  - Test results and the tester's signature must be recorded on the permit form.
  - Instrumentation must be tested and zeroed before each daily use and calibrated according to manufacturer's specifications.
- Attendants.
  - An authorized attendant will be stationed at each confined space.
  - The attendant will not enter the space unless he is relieved, trained and equipped for rescue operations, and a second rescuer arrives to assist.
- Training.
  - All affected personnel must receive annual training.
  - Documentation include signature of the trainee, dates of training, signature of trainer, lesson plan, and verification of each trainee's understanding.
  - Authorized entrants will receive training in:
    - Recognition of hazards.
    - Need to maintain contact with attendants.
    - Proper use of personal protective equipment.
    - Need to evacuate space if ordered by the attendant, O<sub>2</sub>/LFL alarm indicates a hazard, entrant detects a prohibited condition, or the entrant recognizes a warning sign and/or symptoms of exposure to a dangerous situation.
    - All aspects of the permit.
    - Use of the test equipment.

- Attendants will receive training in:
  - All aspects of the permit.
  - Requirement to remain outside confined space.
  - Recognition of hazards.
  - Requirement to maintain visual or verbal contact with entrants.
  - Alerting rescue personnel.
  - Use of test equipment.
- Entry supervisors will receive training in:
  - Determination that the space has been isolated.
  - Determination that permit is complete and correct.
  - Determination that all procedures are in effect before entry.
  - Cancellation of permit.
- Rescue services will receive training in:
  - Use of personal protective equipment and confined space rescue equipment.
  - Methods and procedures to rescue personnel.
- Contractor entry procedures:
  - Since we are a contractor at many facilities, we must be informed by the supervising engineer of:
    - The existence of the confined spaces and the facilities program.
    - Rationale for the designation of permit confined spaces.
    - Precautions and procedures while working in or near a confined space.
    - Debriefing at conclusion of entry.

## TRAINING OUTLINE FOR CONFINED SPACE ENTRANTS

### I. GENERAL HAZARDS OF WORKING IN CONFINED SPACES

#### A. Toxic Substances - Routes of Entry

1. Inhalation
2. Skin Absorption
3. Ingestion

#### B. Oxygen Deficiency - Oxygen 19.5 - 23%

#### C. % LFL Not Greater than 10%

#### D. Noise

#### E. Equipment Hazards

1. Sharp Edges
2. Head Knockers

#### F. Temperature Extremes

1. Heat Stress
2. Cold Stress

#### G. Claustrophobia

#### H. Fall Protection Within Space and at Access Opening

#### I. Chemical Exposures

Introducing Chemicals and Contaminants (Solvents, Cleaners, Maintenance Activities, etc.)

1. Caustic
2. Acid
3. Organics
4. Welding/cutting fumes

#### J. Disturbing Sludge or Vessel Surfaces

1. Sludge can generate chemical vapors and gas
2. Vessel surfaces can collect and then release atmospheric contaminants

K. Toxicology (Examples)

- ! Methylene Chloride
- ! Hydrofluoric Acid
- ! Phenol

L. IDLH Atmospheres

M. Radiation (Ionizing and Non-Ionizing)

N. Dust/Mists

- 1. Proper respiratory protection
- 2. Dust explosion hazard

O. Ventilation

P. Hyperventilation

II. SPECIFIC HAZARDS AT THE FACILITY

III. REASONS FOR, PROPER USE OF, AND LIMITATIONS OF PPE IN CONFINED SPACES

- 1. Respiratory protection
- 2. Gloves
- 3. Chemical suits
- 4. Harness and lifeline
- 5. Hard hat
- 6. Goggles
- 7. Face shield
- 8. Boots/Safety toed shoes

IV. PERMIT SYSTEM

- 1. Explanation of permit
- 2. Duties of entry supervisor
- 3. Duration of permit
- 4. Cancellation of permit

V. ATTENDANT DUTIES

VI. CONFINED SPACE RESCUE

- 1. Rescue plan
- 2. Rescue equipment
- 3. Rescue team

4. Entrant responsibilities

## VII. RECOGNITION OF POTENTIAL OVEREXPOSURE

- A. Self
- B. Others